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Rec'd PCT/PTO 10 OCT 2002

#6

LeA33955-US  
SEQUENCE LISTING

&lt;110&gt; Bayer Aktiengesellschaft

<120> Nucleic acids coding for enzyme activities of  
spinosyn biosynthesis

&lt;130&gt; Le A 33 955

&lt;140&gt;

&lt;141&gt;

&lt;160&gt; 55

&lt;170&gt; PatentIn Ver. 2.1

&lt;210&gt; 1

&lt;211&gt; 50000

&lt;212&gt; DNA

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cta	agc	cac	cgg	gtg	gac	ttc	tcg	tgc	gtc	gat	gcc	atg	tcc	ctg	ccg	384
Leu	Ser	His	Arg	Val	Asp	Phe	Ser	Cys	Val	Asp	Ala	Met	Ser	Leu	Pro	
		115					120					125				
tac	ccg	gac	aat	gct	ttc	gac	gcc	gcc	tgg	gcc	atg	cag	tcg	ctg	ttg	432
Tyr	Pro	Asp	Asn	Ala	Phe	Asp	Ala	Ala	Trp	Ala	Met	Gln	Ser	Leu	Leu	
	130					135					140					
gag	atg	tcc	gaa	ccg	gac	cgt	gcc	atc	cgg	gaa	atc	ctt	cga	gta	ctc	480
Glu	Met	Ser	Glu	Pro	Asp	Arg	Ala	Ile	Arg	Glu	Ile	Leu	Arg	Val	Leu	
	145				150					155					160	
aaa	ccc	ggg	ggc	atc	ctc	ggc	gtc	acc	gag	gtc	gtc	aaa	cga	gaa	gcg	528
Lys	Pro	Gly	Gly	Ile	Leu	Gly	Val	Thr	Glu	Val	Val	Lys	Arg	Glu	Ala	
				165					170					175		
ggc	ggc	ggg	atg	ccg	gtg	tcc	ggg	gac	agg	tgg	ccg	acc	ggc	ctt	cgg	576
Gly	Gly	Gly	Met	Pro	Val	Ser	Gly	Asp	Arg	Trp	Pro	Thr	Gly	Leu	Arg	
			180					185					190			
atc	tgc	ctg	gct	gag	caa	ctt	ctg	gaa	tcg	ctg	cgt	gca	gcg	ggg	ttc	624
Ile	Cys	Leu	Ala	Glu	Gln	Leu	Leu	Glu	Ser	Leu	Arg	Ala	Ala	Gly	Phe	
		195					200					205				
gag	atc	ctc	gat	tgg	gag	gac	gtg	tcg	tcg	agg	acc	cgg	tac	ttc	atg	672
Glu	Ile	Leu	Asp	Trp	Glu	Asp	Val	Ser	Ser	Arg	Thr	Arg	Tyr	Phe	Met	
	210					215					220					
ccg	cag	ttc	gcc	gaa	gag	ctc	gct	gcg	cac	cag	cac	ggg	atc	gcg	gac	720
Pro	Gln	Phe	Ala	Glu	Glu	Leu	Ala	Ala	His	Gln	His	Gly	Ile	Ala	Asp	
	225				230					235					240	
agg	tac	ggg	ccg	gct	gtc	gcc	ggc	tgg	gcc	gcc	gcg	gtc	tgc	gat	tat	768
Arg	Tyr	Gly	Pro	Ala	Val	Ala	Gly	Trp	Ala	Ala	Ala	Val	Cys	Asp	Tyr	
				245					250					255		
gag	aaa	tat	gcc	cac	gac	atg	ggc	tat	gcg	att	ctg	acg	gcg	cgg	aag	816
Glu	Lys	Tyr	Ala	His	Asp	Met	Gly	Tyr	Ala	Ile	Leu	Thr	Ala	Arg	Lys	
			260					265					270			
ccg	gtc	ggc	tga													828
Pro	Val	Gly														
		275														

<210> 8

<211> 275

<212> PRT

<213> Saccharopolyspora spinosa

<400> 8

Val	Leu	Pro	Gly	Gly	Ala	Pro	Thr	Ser	Gln	Gln	Val	Gly	Gln	Met	Tyr	
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Asp	Leu	Val	Thr	Pro	Leu	Leu	Asn	Ser	Val	Ala	Gly	Gly	Pro	Cys	Ala	
			20					25					30			
Ile	His	His	Gly	Tyr	Trp	Glu	Asn	Asp	Gly	Arg	Ala	Ser	Trp	Gln	Gln	
		35					40					45				
Ala	Ala	Asp	Arg	Leu	Thr	Asp	Leu	Val	Ala	Glu	Arg	Thr	Val	Leu	Asp	
	50					55					60					

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Gly Gly Val Arg Leu Leu Asp Val Gly Cys Gly Thr Gly Gln Pro Ala  
65 70 75 80  
Leu Arg Val Ala Arg Asp Asn Ala Ile Gln Ile Thr Gly Ile Thr Val  
85 90 95  
Ser Gln Val Gln Val Ala Ile Ala Ala Asp Cys Ala Arg Glu Arg Gly  
100 105 110  
Leu Ser His Arg Val Asp Phe Ser Cys Val Asp Ala Met Ser Leu Pro  
115 120 125  
Tyr Pro Asp Asn Ala Phe Asp Ala Ala Trp Ala Met Gln Ser Leu Leu  
130 135 140  
Glu Met Ser Glu Pro Asp Arg Ala Ile Arg Glu Ile Leu Arg Val Leu  
145 150 155 160  
Lys Pro Gly Gly Ile Leu Gly Val Thr Glu Val Val Lys Arg Glu Ala  
165 170 175  
Gly Gly Gly Met Pro Val Ser Gly Asp Arg Trp Pro Thr Gly Leu Arg  
180 185 190  
Ile Cys Leu Ala Glu Gln Leu Leu Glu Ser Leu Arg Ala Ala Gly Phe  
195 200 205  
Glu Ile Leu Asp Trp Glu Asp Val Ser Ser Arg Thr Arg Tyr Phe Met  
210 215 220  
Pro Gln Phe Ala Glu Glu Leu Ala Ala His Gln His Gly Ile Ala Asp  
225 230 235 240  
Arg Tyr Gly Pro Ala Val Ala Gly Trp Ala Ala Ala Val Cys Asp Tyr  
245 250 255  
Glu Lys Tyr Ala His Asp Met Gly Tyr Ala Ile Leu Thr Ala Arg Lys  
260 265 270  
Pro Val Gly  
275

<210> 9  
<211> 1173  
<212> DNA  
<213> Saccharopolyspora spinosa

<220>  
<221> CDS  
<222> (1)..(1170)  
<223> ORF2; glycosyltransferase

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Met Arg Val Leu Val Val Pro Leu Pro Tyr Pro Thr His Leu Met Ala  
1 5 10 15  
atg gtg ccg ctg tgc tgg gcg ctg caa gca tcc ggg cac gag gtc ctg 96  
Met Val Pro Leu Cys Trp Ala Leu Gln Ala Ser Gly His Glu Val Leu  
20 25 30

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atc Ile	gcc Ala	gca Ala 35	cca Pro	cca Pro	gag Glu	ctg Leu	cag Gln 40	gcg Ala	acc Thr	gcg Ala	cat His	ggt Gly 45	gca Ala	ggt Gly	ctc Leu	144
acc Thr	acg Thr 50	gcc Ala	ggg Gly	atc Ile	cgc Arg	ggg Gly 55	aac Asn	gac Asp	agg Arg	acc Thr	ggc Gly 60	gat Asp	acg Thr	ggt Gly	gga Gly	192
acc Thr 65	acg Thr	cag Gln	ctg Leu	cgc Arg	ttt Phe 70	ccc Pro	aat Asn	ccg Pro	gcg Ala	ttc Phe 75	ggt Gly	cag Gln	cgc Arg	gac Asp	acc Thr 80	240
gag Glu	gca Ala	ggc Gly	cgg Arg	caa Gln 85	ctg Leu	tgg Trp	gag Glu	cag Gln	acc Thr 90	gcg Ala	tcc Ser	aat Asn	gtc Val	gcg Ala 95	caa Gln	288
agc Ser	tcg Ser	ctc Leu	gat Asp 100	cag Gln	ctc Leu	ccc Pro	gaa Glu	tac Tyr 105	ctt Leu	cga Arg	ctg Leu	gcc Ala 110	gag Glu	gcc Ala	tgg Trp	336
cga Arg	ccg Pro	tca Ser 115	gtg Val	ctg Leu	ttg Leu	gtc Val	gac Asp 120	gtc Val	tgc Cys	gcg Ala	ctg Leu	atc Ile 125	ggc Gly	cgg Arg	gtg Val	384
ctc Leu	ggc Gly 130	gga Gly	ttg Leu	ctc Leu	gac Asp	ctg Leu 135	ccg Pro	gtc Val	gtg Val	ctg Leu	cac His 140	cgc Arg	tgg Trp	gga Gly	gtc Val	432
gac Asp 145	ccc Pro	acc Thr	gca Ala	ggc Gly	ccc Pro 150	ttc Phe	agc Ser	gat Asp	cga Arg	gcc Ala 155	cac His	gag Glu	ttg Leu	ctt Leu	gac Asp 160	480
ccg Pro	gtg Val	tgc Cys	cgg Arg	cac His 165	cac His	gga Gly	ctg Leu	acc Thr	ggc Gly 170	ctg Leu	ccc Pro	act Thr	ccc Pro	gag Glu 175	ctc Leu	528
atc Ile	ctc Leu	gat Asp 180	ccc Pro	tgt Cys	ccg Pro	ccg Pro	agc Ser	ctg Leu 185	caa Gln	gca Ala	agc Ser	gac Asp	gcg Ala 190	ccg Pro	caa Gln	576
ggc Gly	gca Ala	ccg Pro 195	gtc Val	cag Gln	tac Tyr	gtg Val	ccg Pro 200	tac Tyr	aac Asn	gga Gly	agc Ser	ggc Gly 205	gca Ala	ttc Phe	ccg Pro	624
gca Ala	tgg Trp 210	ggc Gly	gcg Ala	gcg Ala	cgc Arg	acc Thr 215	tca Ser	gca Ala	cgg Arg	cgg Arg	gtc Val 220	tgc Cys	atc Ile	tgc Cys	atg Met	672
ggc Gly 225	cgc Arg	atg Met	gtg Val	ctg Leu	aac Asn 230	gcc Ala	acc Thr	ggg Gly	ccg Pro	gct Ala 235	ccg Pro	ctg Leu	ctg Leu	cgc Arg	gca Ala 240	720
gta Val	gcg Ala	gct Ala	gcc Ala	acc Thr 245	gag Glu	ttg Leu	ccc Pro	ggc Gly	gtc Val 250	gag Glu	gcc Ala	gtg Val	atc Ile	gcc Ala 255	gtt Val	768
ccc Pro	ccc Pro	gag Glu	cac His 260	cgg Arg	gca Ala	ctt Leu	ctc Leu	acc Thr 265	gac Asp	cta Leu	ccc Pro	gac Asp	aac Asn	gcc Ala	cgg Arg	816
atc Ile	gcc Ala	gaa Glu	tcg Ser	gtc Val	ccg Pro	ctc Leu	aac Asn	ctg Leu	ttc Phe	ctg Leu	cgt Arg	acc Thr	tgc Cys	gag Glu	ctg Leu	864



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275	280	285	
gtc atc tgc gcg ggc ggc tcg gga acg gca ttc acc gcg acc cga ctc Val Ile Cys Ala Gly Gly Ser Gly Thr Ala Phe Thr Ala Thr Arg Leu			912
	290	300	
ggc atc ccg caa ctc gtg ctt ccc cag tac ttc gac cag ttc gac tac Gly Ile Pro Gln Leu Val Leu Pro Gln Tyr Phe Asp Gln Phe Asp Tyr			960
	305	315	
gcg cgc aac ctc gcc gct gcc ggg gcg ggc atc tgc ttg ccg gat gag Ala Arg Asn Leu Ala Ala Ala Gly Ala Gly Ile Cys Leu Pro Asp Glu			1008
	325	330	
cag gcc cag tcc gac cac gaa cag ttc acc gac tca atc gca acg gtg Gln Ala Gln Ser Asp His Glu Gln Phe Thr Asp Ser Ile Ala Thr Val			1056
	340	345	
ctc ggc gac acc ggc ttc gct gct gcg gca atc aaa ctc agc gac gag Leu Gly Asp Thr Gly Phe Ala Ala Ala Ile Lys Leu Ser Asp Glu			1104
	355	360	
atc acg gcc atg ccc cat ccc gcc gcg ctg gtg cgg acg ctg gag aac Ile Thr Ala Met Pro His Pro Ala Ala Leu Val Arg Thr Leu Glu Asn			1152
	370	375	
act gcg gcc atc cgt gcc tga Thr Ala Ala Ile Arg Ala			1173
	385	390	

<210> 10  
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 <212> PRT  
 <213> Saccharopolyspora spinosa

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 Met Val Pro Leu Cys Trp Ala Leu Gln Ala Ser Gly His Glu Val Leu  
 20 25 30  
 Ile Ala Ala Pro Pro Glu Leu Gln Ala Thr Ala His Gly Ala Gly Leu  
 35 40 45  
 Thr Thr Ala Gly Ile Arg Gly Asn Asp Arg Thr Gly Asp Thr Gly Gly  
 50 55 60  
 Thr Thr Gln Leu Arg Phe Pro Asn Pro Ala Phe Gly Gln Arg Asp Thr  
 65 70 75 80  
 Glu Ala Gly Arg Gln Leu Trp Glu Gln Thr Ala Ser Asn Val Ala Gln  
 85 90 95  
 Ser Ser Leu Asp Gln Leu Pro Glu Tyr Leu Arg Leu Ala Glu Ala Trp  
 100 105 110  
 Arg Pro Ser Val Leu Leu Val Asp Val Cys Ala Leu Ile Gly Arg Val  
 115 120 125  
 Leu Gly Gly Leu Leu Asp Leu Pro Val Val Leu His Arg Trp Gly Val  
 130 135 140

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Asp Pro Thr Ala Gly Pro Phe Ser Asp Arg Ala His Glu Leu Leu Asp  
 145 150 155 160  
 Pro Val Cys Arg His His Gly Leu Thr Gly Leu Pro Thr Pro Glu Leu  
 165 170 175  
 Ile Leu Asp Pro Cys Pro Pro Ser Leu Gln Ala Ser Asp Ala Pro Gln  
 180 185 190  
 Gly Ala Pro Val Gln Tyr Val Pro Tyr Asn Gly Ser Gly Ala Phe Pro  
 195 200 205  
 Ala Trp Gly Ala Ala Arg Thr Ser Ala Arg Arg Val Cys Ile Cys Met  
 210 215 220  
 Gly Arg Met Val Leu Asn Ala Thr Gly Pro Ala Pro Leu Leu Arg Ala  
 225 230 235 240  
 Val Ala Ala Ala Thr Glu Leu Pro Gly Val Glu Ala Val Ile Ala Val  
 245 250 255  
 Pro Pro Glu His Arg Ala Leu Leu Thr Asp Leu Pro Asp Asn Ala Arg  
 260 265 270  
 Ile Ala Glu Ser Val Pro Leu Asn Leu Phe Leu Arg Thr Cys Glu Leu  
 275 280 285  
 Val Ile Cys Ala Gly Gly Ser Gly Thr Ala Phe Thr Ala Thr Arg Leu  
 290 295 300  
 Gly Ile Pro Gln Leu Val Leu Pro Gln Tyr Phe Asp Gln Phe Asp Tyr  
 305 310 315 320  
 Ala Arg Asn Leu Ala Ala Ala Gly Ala Gly Ile Cys Leu Pro Asp Glu  
 325 330 335  
 Gln Ala Gln Ser Asp His Glu Gln Phe Thr Asp Ser Ile Ala Thr Val  
 340 345 350  
 Leu Gly Asp Thr Gly Phe Ala Ala Ala Ile Lys Leu Ser Asp Glu  
 355 360 365  
 Ile Thr Ala Met Pro His Pro Ala Ala Leu Val Arg Thr Leu Glu Asn  
 370 375 380  
 Thr Ala Ala Ile Arg Ala  
 385 390

<210> 11

<211> 753

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1)..(750)

<223> ORF3; O-methyltransferase

<400> 11

atg ccc tcc cag aac gcg ctg tac ctg gac ctg ctc aag aag gta ctc 48

LeA33955-US																
Met 1	Pro	Ser	Gln	Asn 5	Ala	Leu	Tyr	Leu	Asp 10	Leu	Leu	Lys	Lys	Val 15	Leu	
acc Thr	aac Asn	acg Thr	att Ile 20	tac Tyr	agt Ser	gat Asp	cgg Arg	ccg Pro 25	cat His	ccg Pro	aac Asn	gcc Ala	tgg Trp 30	cag Gln	gac Asp	96
aac Asn	acc Thr	gac Asp 35	tac Tyr	agg Arg	cag Gln	gcc Ala	gct Ala 40	cgg Arg	gcc Ala	aaa Lys	ggc Gly	acg Thr 45	gac Asp	tgg Trp	cca Pro	144
act Thr	gtc Val 50	gcg Ala	cac His	acg Thr	atg Met	atc Ile 55	ggg Gly	ctg Leu	gag Glu	cgg Arg	ctg Leu 60	gac Asp	aac Asn	ctc Leu	cag Gln	192
cac His 65	tgc Cys	gtg Val	gaa Glu	gcc Ala	gtg Val 70	ctc Leu	gca Ala	gac Asp	ggg Gly	gtt Val 75	ccc Pro	ggg Gly	gat Asp	ttc Phe	gcc Ala 80	240
gag Glu	acc Thr	ggg Gly	gtc Val	tgg Trp 85	cgg Arg	ggc Gly	ggc Gly	gca Ala	tgc Cys 90	atc Ile	ttc Phe	atg Met	cgc Arg	gcg Ala 95	gtt Val	288
ctc Leu	cag Gln	gca Ala	ttc Phe 100	gga Gly	gat Asp	acc Thr	gga Gly	cgt Arg 105	acc Thr	gtc Val	tgg Trp	gta Val 110	gtg Val	gat Asp	tcc Ser	336
ttc Phe	cag Gln	gga Gly 115	atg Met	ccg Pro	gaa Glu	agc Ser	tct Ser 120	gcg Ala	caa Gln	gac Asp	cac His	caa Gln 125	gcg Ala	gac Asp	cag Gln	384
gct Ala 130	atg Met	gcg Ala	ctg Leu	cac His	gag Glu	tac Tyr 135	aac Asn	gac Asp	gtg Val	ctt Leu	ggc Gly 140	gta Val	tcg Ser	ctt Leu	gag Glu	432
acc Thr 145	gtc Val	cgg Arg	cag Gln	aac Asn	ttc Phe 150	gcc Ala	cgc Arg	tac Tyr	ggg Gly	ctg Leu 155	ctc Leu	gac Asp	gaa Glu	cag Gln	gtc Val 160	480
agg Arg	ttc Phe	ctc Leu	ccc Pro	ggc Gly 165	tgg Trp	ttc Phe	cgg Arg	gac Asp	acc Thr 170	ttg Leu	ccc Pro	acc Thr	gcc Ala	ccc Pro 175	atc Ile	528
cag Gln	gaa Glu	ctc Leu	gcc Ala 180	gtg Val	cta Leu	cga Arg	ctc Leu	gac Asp 185	ggc Gly	gac Asp	ctc Leu	tac Tyr	gaa Glu 190	tcc Ser	aca Thr	576
atg Met	gac Asp	tca Ser 195	ttg Leu	cgg Arg	aac Asn	ctg Leu	tac Tyr 200	ccg Pro	aag Lys	ctc Leu	tcg Ser	ccg Pro 205	ggc Gly	gga Gly	ttc Phe	624
gtc Val	atc Ile 210	atc Ile	gac Asp	gac Asp	tat Tyr	ttt Phe 215	ctg Leu	ccg Pro	tcc Ser	tgc Cys	cag Gln 220	gac Asp	gcg Ala	gtg Val	aag Lys	672
ggg Gly 225	ttc Phe	cgc Arg	gcg Ala	gaa Glu	ctc Leu 230	ggg Gly	atc Ile	acg Thr	gaa Glu	ccc Pro 235	atc Ile	cac His	gac Asp	atc Ile	gac Asp 240	720
ggc Gly	acg Thr	ggc Gly	gcc Ala	tac Tyr 245	tgg Trp	cgc Arg	cgc Arg	agc Ser	tgg Trp 250	tga						753

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<210> 12  
 <211> 250  
 <212> PRT  
 <213> Saccharopolyspora spinosa

<400> 12  
 Met Pro Ser Gln Asn Ala Leu Tyr Leu Asp Leu Leu Lys Lys Val Leu  
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 20 25 30  
 Asn Thr Asp Tyr Arg Gln Ala Ala Arg Ala Lys Gly Thr Asp Trp Pro  
 35 40 45  
 Thr Val Ala His Thr Met Ile Gly Leu Glu Arg Leu Asp Asn Leu Gln  
 50 55 60  
 His Cys Val Glu Ala Val Leu Ala Asp Gly Val Pro Gly Asp Phe Ala  
 65 70 75 80  
 Glu Thr Gly Val Trp Arg Gly Gly Ala Cys Ile Phe Met Arg Ala Val  
 85 90 95  
 Leu Gln Ala Phe Gly Asp Thr Gly Arg Thr Val Trp Val Val Asp Ser  
 100 105 110  
 Phe Gln Gly Met Pro Glu Ser Ser Ala Gln Asp His Gln Ala Asp Gln  
 115 120 125  
 Ala Met Ala Leu His Glu Tyr Asn Asp Val Leu Gly Val Ser Leu Glu  
 130 135 140  
 Thr Val Arg Gln Asn Phe Ala Arg Tyr Gly Leu Leu Asp Glu Gln Val  
 145 150 155 160  
 Arg Phe Leu Pro Gly Trp Phe Arg Asp Thr Leu Pro Thr Ala Pro Ile  
 165 170 175  
 Gln Glu Leu Ala Val Leu Arg Leu Asp Gly Asp Leu Tyr Glu Ser Thr  
 180 185 190  
 Met Asp Ser Leu Arg Asn Leu Tyr Pro Lys Leu Ser Pro Gly Gly Phe  
 195 200 205  
 Val Ile Ile Asp Asp Tyr Phe Leu Pro Ser Cys Gln Asp Ala Val Lys  
 210 215 220  
 Gly Phe Arg Ala Glu Leu Gly Ile Thr Glu Pro Ile His Asp Ile Asp  
 225 230 235 240  
 Gly Thr Gly Ala Tyr Trp Arg Arg Ser Trp  
 245 250

<210> 13  
 <211> 1188  
 <212> DNA  
 <213> Saccharopolyspora spinosa

<220>

## LeA33955-US

&lt;221&gt; CDS

&lt;222&gt; (1)..(1185)

&lt;223&gt; ORF4; O-methyltransferase

&lt;400&gt; 13

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Met Ser Glu Ile Ala Val Ala Pro Trp Ser Val Val Glu Arg Leu Leu	
1 5 10 15	
ctc gcg gcg ggt gcg ggc ccg gcg aag ctc cag gaa gca gtg cag gtg	96
Leu Ala Ala Gly Ala Gly Pro Ala Lys Leu Gln Glu Ala Val Gln Val	
20 25 30	
gcc gga ctg gac gcg gtg gcc gac gcc atc gtc gac gaa ctc gtc gta	144
Ala Gly Leu Asp Ala Val Ala Asp Ala Ile Val Asp Glu Leu Val Val	
35 40 45	
cgc tgc gat ccg ctg tgc ttg gac gag tgc gtg cga atc ggc ctg gag	192
Arg Cys Asp Pro Leu Ser Leu Asp Glu Ser Val Arg Ile Gly Leu Glu	
50 55 60	
atc act tct ggc gct cag ctg gtc cgg aga acc gtt gag ctc gat cac	240
Ile Thr Ser Gly Ala Gln Leu Val Arg Arg Thr Val Glu Leu Asp His	
65 70 75 80	
gca ggc ctg cgg ctc gcg gcg gtc gcc gaa gca gct gct gtt ctc cgg	288
Ala Gly Leu Arg Leu Ala Ala Val Ala Glu Ala Ala Val Leu Arg	
85 90 95	
ttc gac gcg gtg gat ctg ctg gaa ggc ctc ttc ggc ccg gtt gac ggc	336
Phe Asp Ala Val Asp Leu Leu Glu Gly Leu Phe Gly Pro Val Asp Gly	
100 105 110	
agg cgg cac aac agc cgt gaa gtc cgc tgg tgc gac agc atg acg cag	384
Arg Arg His Asn Ser Arg Glu Val Arg Trp Ser Asp Ser Met Thr Gln	
115 120 125	
ttc tgc ccc gac cag ggc ctc gcc ggc gcg cag cgc ctg ctg gcg ttc	432
Phe Ser Pro Asp Gln Gly Leu Ala Gly Ala Gln Arg Leu Leu Ala Phe	
130 135 140	
cgg aac agg gtg tcc acc gcg gtg cac gcc gtg ctg gcc gca gcc gcc	480
Arg Asn Arg Val Ser Thr Ala Val His Ala Val Leu Ala Ala Ala Ala	
145 150 155 160	
acc agg cgc gcg gac ctc ggt gcg ctg gca gtc cgc tac gga tcc gac	528
Thr Arg Arg Ala Asp Leu Gly Ala Leu Ala Val Arg Tyr Gly Ser Asp	
165 170 175	
aaa tgg gcg gac ctg cac tgg tac acc gaa cac tac gag cac cac ttc	576
Lys Trp Ala Asp Leu His Trp Tyr Thr Glu His Tyr Glu His His Phe	
180 185 190	
tcc cga ttc cag gat gcc ccg gtg cga gtg ttg gaa ata gga atc ggt	624
Ser Arg Phe Gln Asp Ala Pro Val Arg Val Leu Glu Ile Gly Ile Gly	
195 200 205	
ggt tat cac gca ccc gaa ctc ggt ggt gct tgc ctg cgc atg tgg cag	672
Gly Tyr His Ala Pro Glu Leu Gly Gly Ala Ser Leu Arg Met Trp Gln	
210 215 220	
cgg tac ttc cgg cga ggt ctc gtt tac ggg ctg gac att ttc gag aaa	720
Arg Tyr Phe Arg Arg Gly Leu Val Tyr Gly Leu Asp Ile Phe Glu Lys	

LeA33955-US																
225				230				235				240				
gcc Ala	ggg Gly	aac Asn	gaa Glu	ggg Gly 245	cac His	cga Arg	gtg Val	cga Arg	aag Lys 250	ctg Leu	cga Arg	ggt Gly	gac Asp	cag Gln 255	agc Ser	768
gat Asp	gcg Ala	gaa Glu	ttc Phe 260	ctg Leu	gaa Glu	gac Asp	atg Met	gcg Ala 265	ggg Gly	aag Lys	atc Ile	ggg Gly	ccg Pro 270	ttc Phe	gac Asp	816
att Ile	gtc Val	atc Ile 275	gac Asp	gac Asp	ggc Gly	agc Ser	cat His 280	gtc Val	aac Asn	gac Asp	cac His	gtc Val 285	aag Lys	aaa Lys	tcc Ser	864
ttc Phe	caa Gln 290	tcc Ser	ctg Leu	ttt Phe	ccg Pro	cac His 295	gtc Val	cgc Arg	cca Pro	ggt Gly	ggt Gly 300	ttg Leu	tac Tyr	gtc Val	atc Ile	912
gag Glu 305	gat Asp	ctc Leu	cag Gln	acg Thr	gcg Ala 310	tac Tyr	tgg Trp	ccc Pro	ggc Gly	tac Tyr 315	ggc Gly	ggt Gly	cgc Arg	gat Asp	ggg Gly 320	960
gaa Glu	ccc Pro	gcg Ala	gcc Ala	cag Gln 325	cgc Arg	acc Thr	tcg Ser	atc Ile	gac Asp 330	atg Met	ctc Leu	aaa Lys	gaa Glu	ctg Leu 335	atc Ile	1008
gac Asp	ggc Gly	ctg Leu	cat His 340	tat Tyr	cag Gln	gag Glu	cgc Arg	gaa Glu 345	tcg Ser	cgg Arg	tgc Cys	ggg Gly	acc Thr 350	gag Glu	ccc Pro	1056
tcc Ser	tac Tyr	acg Thr 355	gaa Glu	cgg Arg	aac Asn	gtg Val	gcg Ala 360	gcc Ala	ctg Leu	cac His	ttc Phe	tac Tyr 365	cac His	aac Asn	ctg Leu	1104
gta Val	ttc Phe 370	gtg Val	gag Glu	aaa Lys	ggg Gly	ctc Leu 375	aac Asn	gct Ala	gag Glu	cct Pro	gcc Ala 380	gcg Ala	ccg Pro	ggg Gly	ttc Phe	1152
gtg Val 385	ccc Pro	cgg Arg	caa Gln	gcg Ala	ctc Leu 390	ggc Gly	gtc Val	gag Glu	gac Asp	ggc Gly 395	tga					1188



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Ala Gly Leu Arg Leu 85 Ala Ala Val Ala Glu 90 Ala Ala Ala Val Leu Arg 95  
Phe Asp Ala Val 100 Asp Leu Leu Glu Gly 105 Leu Phe Gly Pro Val 110 Asp Gly  
Arg Arg His 115 Asn Ser Arg Glu Val 120 Arg Trp Ser Asp Ser 125 Met Thr Gln  
Phe Ser 130 Pro Asp Gln Gly Leu 135 Ala Gly Ala Gln Arg 140 Leu Leu Ala Phe  
Arg 145 Asn Arg Val Ser Thr 150 Ala Val His Ala Val 155 Leu Ala Ala Ala Ala 160  
Thr Arg Arg Ala Asp 165 Leu Gly Ala Leu Ala Val 170 Arg Tyr Gly Ser 175 Asp  
Lys Trp Ala Asp 180 Leu His Trp Tyr Thr 185 Glu His Tyr Glu His 190 His Phe  
Ser Arg Phe 195 Gln Asp Ala Pro Val 200 Arg Val Leu Glu Ile 205 Gly Ile Gly  
Gly Tyr 210 His Ala Pro Glu Leu 215 Gly Gly Ala Ser Leu 220 Arg Met Trp Gln  
Arg 225 Tyr Phe Arg Arg Gly 230 Leu Val Tyr Gly Leu 235 Asp Ile Phe Glu Lys 240  
Ala Gly Asn Glu Gly 245 His Arg Val Arg Lys 250 Leu Arg Gly Asp Gln Ser 255  
Asp Ala Glu Phe 260 Leu Glu Asp Met Ala 265 Gly Lys Ile Gly Pro Phe Asp 270  
Ile Val Ile 275 Asp Asp Gly Ser His 280 Val Asn Asp His Val 285 Lys Lys Ser  
Phe Gln 290 Ser Leu Phe Pro His 295 Val Arg Pro Gly Gly 300 Leu Tyr Val Ile  
Glu 305 Asp Leu Gln Thr Ala 310 Tyr Trp Pro Gly Tyr 315 Gly Gly Arg Asp Gly 320  
Glu Pro Ala Ala Gln 325 Arg Thr Ser Ile Asp 330 Met Leu Lys Glu Leu 335 Ile  
Asp Gly Leu His 340 Tyr Gln Glu Arg Glu 345 Ser Arg Cys Gly Thr 350 Glu Pro  
Ser Tyr Thr 355 Glu Arg Asn Val Ala 360 Ala Leu His Phe Tyr 365 His Asn Leu  
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Val 385 Pro Arg Gln Ala Leu 390 Gly Val Glu Asp Gly 395

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 <213> Saccharopolyspora spinosa

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 <222> (1)..(1617)  
 <223> ORF5; C-C linking enzyme, cyclization enzyme

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 gcg gtg ccc gaa ttc cat gac ccg gca ccc atg aat cgt cga acc cca 96  
 Ala Val Pro Glu Phe His Asp Pro Ala Pro Met Asn Arg Arg Thr Pro  
 20 25 30  
 gga aca gag atc acc gtc gag ccc gac gat cct cgt tat ccg gac ctc 144  
 Gly Thr Glu Ile Thr Val Glu Pro Asp Asp Pro Arg Tyr Pro Asp Leu  
 35 40 45  
 gtc gtc ggg cac aac ccc cgt ttc acc gga aaa ccc gaa cgc atc cac 192  
 Val Val Gly His Asn Pro Arg Phe Thr Gly Lys Pro Glu Arg Ile His  
 50 55 60  
 atc gcc agc tcc gcc gaa gac gtc gtg cac gcc gtc gcc gac gcc gtg 240  
 Ile Ala Ser Ser Ala Glu Asp Val Val His Ala Val Ala Asp Ala Val  
 65 70 75 80  
 cgc acc ggc agg cgg gta ggg gtc cgc agc ggc ggg cac tgc ttc gag 288  
 Arg Thr Gly Arg Arg Val Gly Val Arg Ser Gly Gly His Cys Phe Glu  
 85 90 95  
 aat ctc gtt gcg gac ccg gcg atc cga gtg ctc gtc gac ctc tcc gag 336  
 Asn Leu Val Ala Asp Pro Ala Ile Arg Val Leu Val Asp Leu Ser Glu  
 100 105 110  
 ctc aac cgc gtg tac tac gac agc acg cgc ggg gca ttc gcg atc gag 384  
 Leu Asn Arg Val Tyr Tyr Asp Ser Thr Arg Gly Ala Phe Ala Ile Glu  
 115 120 125  
 gcg ggc gcc gcc ctc ggg cag gtg tac cga acc ctg ttc aag aac tgg 432  
 Ala Gly Ala Ala Leu Gly Gln Val Tyr Arg Thr Leu Phe Lys Asn Trp  
 130 135 140  
 ggc gtg acg atc ccg acc ggc gca tgt ccc ggg gtg ggc gca ggc ggg 480  
 Gly Val Thr Ile Pro Thr Gly Ala Cys Pro Gly Val Gly Ala Gly Gly  
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 His Ile Leu Gly Gly Gly Tyr Gly Pro Leu Ser Arg Arg Phe Gly Ser  
 165 170 175  
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 Val Val Asp Tyr Leu Gln Gly Val Glu Val Val Val Val Asp Gln Ala  
 180 185 190  
 ggt gaa gtg cac atc gtc gag gcc gac cgg aac tcc acg ggc gcc ggt 624  
 Gly Glu Val His Ile Val Glu Ala Asp Arg Asn Ser Thr Gly Ala Gly  
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atc Ile 225	gtc Val	acc Thr	agg Arg	ttt Phe	tgg Trp 230	ctc Leu	cga Arg	acg Thr	ccg Pro	gac Asp 235	gtg Val	gtc Val	agc Ser	acc Thr	gac Asp 240	720
gcc Ala	gca Ala	gag Glu	ctc Leu	ctg Leu 245	cca Pro	cgg Arg	ccg Pro	ccc Pro	gcg Ala 250	aca Thr	gtg Val	ctg Leu	ctc Leu	cga Arg 255	tcg Ser	768
ttc Phe	cac His	tgg Trp	ccg Pro 260	tgg Trp	cac His	gaa Glu	ctg Leu	aca Thr 265	gag Glu	cag Gln	tca Ser	ttc Phe	gcc Ala 270	gtg Val	ctc Leu	816
cta Leu	cag Gln	aac Asn 275	ttc Phe	ggc Gly	aat Asn	tgg Trp	tac Tyr 280	gag Glu	cag Gln	cac His	agc Ser	gcg Ala 285	cct Pro	gaa Glu	tcc Ser	864
acg Thr	caa Gln 290	ctc Leu	ggg Gly	ttg Leu	ttc Phe	agc Ser 295	acg Thr	ctc Leu	gtc Val	tgc Cys	gca Ala 300	cac His	cgg Arg	caa Gln	gct Ala	912
ggc Gly 305	tac Tyr	gtc Val	acg Thr	ctg Leu	aac Asn 310	gtt Val	cac His	ctg Leu	gac Asp	ggc Gly 315	acg Thr	gat Asp	ccg Pro	aac Asn	gcg Ala 320	960
gaa Glu	cgc Arg	acc Thr	ctg Leu	gcc Ala 325	gaa Glu	cac His	ctg Leu	tcg Ser	gcg Ala 330	atc Ile	aac Asn	gcc Ala	cag Gln	gtc Val 335	ggc Gly	1008
gtg Val	act Thr	cca Pro	gcc Ala 340	gaa Glu	ggg Gly	ctg Leu	cgg Arg	gaa Glu 345	acc Thr	ctg Leu	ccg Pro	tgg Trp	ttg Leu 350	cga Arg	tcg Ser	1056
acc Thr	cag Gln	gtg Val 355	gcc Ala	ggg Gly	gcg Ala	atc Ile	gcc Ala 360	gaa Glu	ggc Gly	ggc Gly	gaa Glu	ccg Pro 365	ggc Gly	atg Met	caa Gln	1104
cgg Arg	acc Thr 370	aag Lys	gtc Val	aaa Lys	gcc Ala	gcc Ala 375	tac Tyr	ttg Leu	cgc Arg	acc Thr	ggg Gly 380	ctg Leu	tcc Ser	gaa Glu	gct Ala	1152
caa Gln 385	cta Leu	gcc Ala	acg Thr	gtt Val	tac Tyr 390	cgg Arg	cgg Arg	ctg Leu	acc Thr	gtc Val 395	tac Tyr	gga Gly	tac Tyr	gac Asp	aac Asn 400	1200
cct Pro	gcg Ala	gcg Ala	gcg Ala	ctg Leu 405	ttg Leu	ctg Leu	ctc Leu	ggg Gly	tac Tyr 410	ggc Gly	ggg Gly	atg Met	gcg Ala	aac Asn 415	gcc Ala	1248
gtg Val	gct Ala	ccg Pro	tcg Ser 420	gcc Ala	acc Thr	gca Ala	ctc Leu	gct Ala 425	cag Gln	cgc Arg	gac Asp	tcg Ser	gtt Val 430	ctc Leu	aaa Lys	1296
gcg Ala	ctg Leu	ttc Phe 435	gtc Val	acg Thr	aac Asn	tgg Trp	tcg Ser 440	gag Glu	ccc Pro	gcc Ala	gag Glu	gac Asp 445	gag Glu	cgg Arg	cat His	1344
ctg Leu	acc Thr 450	tgg Trp	att Ile	cgc Arg	ggg Gly	ttc Phe 455	tac Tyr	cgc Arg	gag Glu	atg Met	tac Tyr 460	gcc Ala	gaa Glu	acc Thr	ggc Gly	1392

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Gly Val Pro Val Pro Gly Thr Arg Val Asp Gly Ser Tyr Ile Asn Tyr	
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ccg gac acc gac ttg gcc gat cca ttg tgg aac acc tcc ggt gtt gcc	1488
Pro Asp Thr Asp Leu Ala Asp Pro Leu Trp Asn Thr Ser Gly Val Ala	
485 490 495	
tgg cac gac ctg tac tac aaa gac aac tac ccg cgg ctg cag cgg gcc	1536
Trp His Asp Leu Tyr Tyr Lys Asp Asn Tyr Pro Arg Leu Gln Arg Ala	
500 505 510	
aaa gcg cgg tgg gat ccg cag aac atc ttc cag cac ggc ctg tcg atc	1584
Lys Ala Arg Trp Asp Pro Gln Asn Ile Phe Gln His Gly Leu Ser Ile	
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Lys Pro Pro Ala Arg Leu Ser Pro Gly Gln Pro	
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 <213> Saccharopolyspora spinosa

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 35 40 45  
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 50 55 60  
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 Arg Thr Gly Arg Arg Val Gly Val Arg Ser Gly Gly His Cys Phe Glu  
 85 90 95  
 Asn Leu Val Ala Asp Pro Ala Ile Arg Val Leu Val Asp Leu Ser Glu  
 100 105 110  
 Leu Asn Arg Val Tyr Tyr Asp Ser Thr Arg Gly Ala Phe Ala Ile Glu  
 115 120 125  
 Ala Gly Ala Ala Leu Gly Gln Val Tyr Arg Thr Leu Phe Lys Asn Trp  
 130 135 140  
 Gly Val Thr Ile Pro Thr Gly Ala Cys Pro Gly Val Gly Ala Gly Gly  
 145 150 155 160  
 His Ile Leu Gly Gly Gly Tyr Gly Pro Leu Ser Arg Arg Phe Gly Ser  
 165 170 175  
 Val Val Asp Tyr Leu Gln Gly Val Glu Val Val Val Val Asp Gln Ala  
 180 185 190

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Gly Glu Val His Ile Val Glu Ala Asp Arg Asn Ser Thr Gly Ala Gly  
 195 200 205  
 His Asp Leu Trp Trp Ala His Thr Gly Gly Gly Gly Gly Asn Phe Gly  
 210 215 220  
 Ile Val Thr Arg Phe Trp Leu Arg Thr Pro Asp Val Val Ser Thr Asp  
 225 230 235 240  
 Ala Ala Glu Leu Leu Pro Arg Pro Pro Ala Thr Val Leu Leu Arg Ser  
 245 250 255  
 Phe His Trp Pro Trp His Glu Leu Thr Glu Gln Ser Phe Ala Val Leu  
 260 265 270  
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 275 280 285  
 Thr Gln Leu Gly Leu Phe Ser Thr Leu Val Cys Ala His Arg Gln Ala  
 290 295 300  
 Gly Tyr Val Thr Leu Asn Val His Leu Asp Gly Thr Asp Pro Asn Ala  
 305 310 315 320  
 Glu Arg Thr Leu Ala Glu His Leu Ser Ala Ile Asn Ala Gln Val Gly  
 325 330 335  
 Val Thr Pro Ala Glu Gly Leu Arg Glu Thr Leu Pro Trp Leu Arg Ser  
 340 345 350  
 Thr Gln Val Ala Gly Ala Ile Ala Glu Gly Gly Glu Pro Gly Met Gln  
 355 360 365  
 Arg Thr Lys Val Lys Ala Ala Tyr Leu Arg Thr Gly Leu Ser Glu Ala  
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 Gln Leu Ala Thr Val Tyr Arg Arg Leu Thr Val Tyr Gly Tyr Asp Asn  
 385 390 395 400  
 Pro Ala Ala Ala Leu Leu Leu Leu Gly Tyr Gly Gly Met Ala Asn Ala  
 405 410 415  
 Val Ala Pro Ser Ala Thr Ala Leu Ala Gln Arg Asp Ser Val Leu Lys  
 420 425 430  
 Ala Leu Phe Val Thr Asn Trp Ser Glu Pro Ala Glu Asp Glu Arg His  
 435 440 445  
 Leu Thr Trp Ile Arg Gly Phe Tyr Arg Glu Met Tyr Ala Glu Thr Gly  
 450 455 460  
 Gly Val Pro Val Pro Gly Thr Arg Val Asp Gly Ser Tyr Ile Asn Tyr  
 465 470 475 480  
 Pro Asp Thr Asp Leu Ala Asp Pro Leu Trp Asn Thr Ser Gly Val Ala  
 485 490 495  
 Trp His Asp Leu Tyr Tyr Lys Asp Asn Tyr Pro Arg Leu Gln Arg Ala  
 500 505 510  
 Lys Ala Arg Trp Asp Pro Gln Asn Ile Phe Gln His Gly Leu Ser Ile  
 515 520 525

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Lys Pro Pro Ala Arg Leu Ser Pro Gly Gln Pro  
530 535

<210> 17  
<211> 1194  
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<213> Saccharopolyspora spinosa

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<222> (1)..(1191)  
<223> ORF6; methyltransferase

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gcc gga tcc agt gcg gcg agc ctg gcc gac ctg acc acc gaa ctc gga 96
Ala Gly Ser Ser Ala Ala Ser Leu Ala Asp Leu Thr Thr Glu Leu Gly
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ctc gcc agg atc gca ccc gtg ctg atc gac gag atc ctc ttc cgc gcg 144
Leu Ala Arg Ile Ala Pro Val Leu Ile Asp Glu Ile Leu Phe Arg Ala
35 40 45

gaa ccg gcc ccc gac atc gaa cgg acc gag gtc gcg gtc cag atc acc 192
Glu Pro Ala Pro Asp Ile Glu Arg Thr Glu Val Ala Val Gln Ile Thr
50 55 60

cac cga ggc gag acc gtt gac ttc gtc ctg acg cta cag tcc ggt gag 240
His Arg Gly Glu Thr Val Asp Phe Val Leu Thr Leu Gln Ser Gly Glu
65 70 75 80

ctg atc aag gcc gag caa cga ccg gtc gga gac gtc ccg ctg cgg atc 288
Leu Ile Lys Ala Glu Gln Arg Pro Val Gly Asp Val Pro Leu Arg Ile
85 90 95

ggt tac gag ctc acc gat ctc atc gcc gag ttg ttc ggc cca gga gct 336
Gly Tyr Glu Leu Thr Asp Leu Ile Ala Glu Leu Phe Gly Pro Gly Ala
100 105 110

ccc agg gcc gtc ggc gcc cgg agc acc aac ttc ctc cga acc acc aca 384
Pro Arg Ala Val Gly Ala Arg Ser Thr Asn Phe Leu Arg Thr Thr Thr
115 120 125

tcc ggt tcg ata ccc ggt ccg tcg gaa ctg tcc gat ggc ttc cag gcc 432
Ser Gly Ser Ile Pro Gly Pro Ser Glu Leu Ser Asp Gly Phe Gln Ala
130 135 140

atc tcc gca gtg gtc gcc ggc tgc ggg cac cga cgt ccc gac ctc aac 480
Ile Ser Ala Val Val Ala Gly Cys Gly His Arg Arg Pro Asp Leu Asn
145 150 155 160

ttg ctc gcc tcc cac tac cgc acg gac aag tgg ggc ggc ctg cac tgg 528
Leu Leu Ala Ser His Tyr Arg Thr Asp Lys Trp Gly Gly Leu His Trp
165 170 175

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Phe Thr Pro Leu Tyr Glu Arg His Leu Gly Glu Phe Arg Asp Arg Pro

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ggc	ggc	gaa	tcc	ctg	aag	atg	tgg	aag	cgc	tac	ttc	cac	cgc	ggc	ctc	672
Gly	Gly	Glu	Ser	Leu	Lys	Met	Trp	Lys	Arg	Tyr	Phe	His	Arg	Gly	Leu	
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Val	Phe	Gly	Met	Asp	Val	Phe	Asp	Lys	Ser	Phe	Leu	Asp	Gln	Gln	Arg	
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Leu	Cys	Thr	Val	Arg	Ala	Asp	Gln	Ser	Lys	Pro	Glu	Glu	Leu	Ala	Ala	
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Val	Asp	Asp	Lys	Tyr	Gly	Pro	Phe	Asp	Ile	Ile	Ile	Asp	Asp	Gly	Ser	
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cac	atc	aac	gga	cac	gtg	cgc	aca	tcc	ctg	gaa	acg	ctg	ttc	ccc	cgg	864
His	Ile	Asn	Gly	His	Val	Arg	Thr	Ser	Leu	Glu	Thr	Leu	Phe	Pro	Arg	
		275					280					285				
ttg	cgc	agc	ggt	ggc	gta	tac	gtg	atc	gag	gat	ctg	tgg	acg	acc	tat	912
Leu	Arg	Ser	Gly	Gly	Val	Tyr	Val	Ile	Glu	Asp	Leu	Trp	Thr	Thr	Tyr	
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gct	ccc	gga	ttc	ggc	ggg	cag	gcg	cag	tgc	ccg	gcc	gca	ccc	ggc	acc	960
Ala	Pro	Gly	Phe	Gly	Gly	Gln	Ala	Gln	Cys	Pro	Ala	Ala	Pro	Gly	Thr	
305					310					315					320	
acg	gtc	agc	ctg	ctc	aag	aac	ctg	ttg	gaa	ggc	ggt	cag	cac	gag	gag	1008
Thr	Val	Ser	Leu	Leu	Lys	Asn	Leu	Leu	Glu	Gly	Val	Gln	His	Glu	Glu	
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cag	ccg	cat	gcg	ggc	tcg	tac	gag	ccg	agc	tac	ctg	gaa	cgc	aat	ttg	1056
Gln	Pro	His	Ala	Gly	Ser	Tyr	Glu	Pro	Ser	Tyr	Leu	Glu	Arg	Asn	Leu	
			340					345					350			
gtc	ggc	ctc	cac	acc	tac	cac	aac	atc	gcg	ttc	ctg	gag	aaa	ggc	gtc	1104
Val	Gly	Leu	His	Thr	Tyr	His	Asn	Ile	Ala	Phe	Leu	Glu	Lys	Gly	Val	
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aac	gcc	gaa	ggc	ggc	ggt	cct	gct	tgg	gtg	cca	agg	agt	ctg	gac	gac	1152
Asn	Ala	Glu	Gly	Gly	Val	Pro	Ala	Trp	Val	Pro	Arg	Ser	Leu	Asp	Asp	
	370					375					380					
ata	ttg	cac	ctg	gcc	gac	gtg	aac	agc	gcg	gag	gac	gag	tga			1194
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<212> PRT

<213> Saccharopolyspora spinosa

<400> 18

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Leu Ala Arg Ile Ala Pro Val Leu Ile Asp Glu Ile Leu Phe Arg Ala  
35 40 45  
Glu Pro Ala Pro Asp Ile Glu Arg Thr Glu Val Ala Val Gln Ile Thr  
50 55 60  
His Arg Gly Glu Thr Val Asp Phe Val Leu Thr Leu Gln Ser Gly Glu  
65 70 75 80  
Leu Ile Lys Ala Glu Gln Arg Pro Val Gly Asp Val Pro Leu Arg Ile  
85 90 95  
Gly Tyr Glu Leu Thr Asp Leu Ile Ala Glu Leu Phe Gly Pro Gly Ala  
100 105 110  
Pro Arg Ala Val Gly Ala Arg Ser Thr Asn Phe Leu Arg Thr Thr Thr  
115 120 125  
Ser Gly Ser Ile Pro Gly Pro Ser Glu Leu Ser Asp Gly Phe Gln Ala  
130 135 140  
Ile Ser Ala Val Val Ala Gly Cys Gly His Arg Arg Pro Asp Leu Asn  
145 150 155 160  
Leu Leu Ala Ser His Tyr Arg Thr Asp Lys Trp Gly Gly Leu His Trp  
165 170 175  
Phe Thr Pro Leu Tyr Glu Arg His Leu Gly Glu Phe Arg Asp Arg Pro  
180 185 190  
Val Arg Ile Leu Glu Ile Gly Val Gly Gly Tyr Asn Phe Asp Gly Gly  
195 200 205  
Gly Gly Glu Ser Leu Lys Met Trp Lys Arg Tyr Phe His Arg Gly Leu  
210 215 220  
Val Phe Gly Met Asp Val Phe Asp Lys Ser Phe Leu Asp Gln Gln Arg  
225 230 235 240  
Leu Cys Thr Val Arg Ala Asp Gln Ser Lys Pro Glu Glu Leu Ala Ala  
245 250 255  
Val Asp Asp Lys Tyr Gly Pro Phe Asp Ile Ile Ile Asp Asp Gly Ser  
260 265 270  
His Ile Asn Gly His Val Arg Thr Ser Leu Glu Thr Leu Phe Pro Arg  
275 280 285  
Leu Arg Ser Gly Gly Val Tyr Val Ile Glu Asp Leu Trp Thr Thr Tyr  
290 295 300  
Ala Pro Gly Phe Gly Gly Gln Ala Gln Cys Pro Ala Ala Pro Gly Thr  
305 310 315 320  
Thr Val Ser Leu Leu Lys Asn Leu Leu Glu Gly Val Gln His Glu Glu  
325 330 335  
Gln Pro His Ala Gly Ser Tyr Glu Pro Ser Tyr Leu Glu Arg Asn Leu  
340 345 350

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Val Gly Leu His Thr Tyr His Asn Ile Ala Phe Leu Glu Lys Gly Val  
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 <223> ORF7; O-methyltransferase

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 Val Glu Ser Ile Phe Asp Ala Leu Ala His Gly Arg Pro Leu His His  
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 Gly Tyr Trp Ala Gly Gly Tyr Arg Glu Asp Ala Gly Ala Thr Pro Trp  
 35 40 45  
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 Ser Asp Ala Ala Asp Gln Leu Thr Asp Leu Phe Ile Asp Lys Ala Ala  
 50 55 60  
 ctc cgt ccc gga gcg cac ctg ttc gac ctg ggc tgc ggc aat ggg cag 240  
 Leu Arg Pro Gly Ala His Leu Phe Asp Leu Gly Cys Gly Asn Gly Gln  
 65 70 75 80  
 ccc gta gtc cgt gcg gca tgc gcc agc ggc gtt cga gtc acc gga atc 288  
 Pro Val Val Arg Ala Ala Cys Ala Ser Gly Val Arg Val Thr Gly Ile  
 85 90 95  
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 Thr Val Asn Ala Gln His Leu Ala Ala Ala Thr Arg Leu Ala Asn Glu  
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 Thr Gly Leu Ala Gly Ser Leu Glu Phe Asp Leu Val Asp Gly Ala Gln  
 115 120 125  
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 Leu Pro Tyr Pro Asp Gly Phe Phe Gln Ala Ala Trp Ala Met Gln Ser  
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 gtc gtg cag atc gtg gac cag gcc gcc gcg atc cgc gag gtc cac cga 480  
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Val	Arg	Leu	Pro	Glu	Glu	Tyr	Ala	Ala	Val	Trp	Thr	Gly	Thr	Thr	Ala	
			180					185					190			
cat	acc	ttg	aac	agc	ttc	acg	gcg	ctg	gtc	agc	gaa	gcc	ggg	ttc	gag	624
His	Thr	Leu	Asn	Ser	Phe	Thr	Ala	Leu	Val	Ser	Glu	Ala	Gly	Phe	Glu	
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Ile	Leu	Glu	Val	Thr	Asp	Leu	Thr	Ala	Gln	Thr	Arg	Cys	Met	Val	Ser	
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Trp	Tyr	Val	Asp	Glu	Leu	Leu	Arg	Lys	Leu	Asp	Glu	Leu	Ala	Gly	Val	
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Glu	Pro	Ala	Ala	Val	Gly	Thr	Tyr	Gln	Gln	Arg	Tyr	Leu	Gly	Asp	Ile	
				245					250					255		
gcg	gcg	aag	cac	gga	ccg	gga	cca	gca	cag	ctg	atc	gcc	gcg	gtt	gcg	816
Ala	Ala	Lys	His	Gly	Pro	Gly	Pro	Ala	Gln	Leu	Ile	Ala	Ala	Val	Ala	
			260					265					270			
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Glu	Tyr	Arg	Lys	His	Pro	Asp	Tyr	Ala	Arg	Asn	Glu	Glu	Ser	Met	Gly	
		275					280					285				
ttc	atg	ctc	ctg	cag	gct	cga	aag	aag	cag	tcc	tga					900
Phe	Met	Leu	Leu	Gln	Ala	Arg	Lys	Lys	Gln	Ser						
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 <212> PRT  
 <213> *Saccharopolyspora spinosa*

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 Gly Tyr Trp Ala Gly Gly Tyr Arg Glu Asp Ala Gly Ala Thr Pro Trp  
 35 40 45  
 Ser Asp Ala Ala Asp Gln Leu Thr Asp Leu Phe Ile Asp Lys Ala Ala  
 50 55 60  
 Leu Arg Pro Gly Ala His Leu Phe Asp Leu Gly Cys Gly Asn Gly Gln  
 65 70 75 80  
 Pro Val Val Arg Ala Ala Cys Ala Ser Gly Val Arg Val Thr Gly Ile  
 85 90 95  
 Thr Val Asn Ala Gln His Leu Ala Ala Ala Thr Arg Leu Ala Asn Glu  
 100 105 110

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Thr Gly Leu Ala Gly Ser Leu Glu Phe Asp Leu Val Asp Gly Ala Gln  
115 120 125  
Leu Pro Tyr Pro Asp Gly Phe Phe Gln Ala Ala Trp Ala Met Gln Ser  
130 135 140  
Val Val Gln Ile Val Asp Gln Ala Ala Ala Ile Arg Glu Val His Arg  
145 150 155 160  
Ile Leu Glu Pro Gly Gly Arg Phe Val Leu Gly Asp Ile Ile Thr Arg  
165 170 175  
Val Arg Leu Pro Glu Glu Tyr Ala Ala Val Trp Thr Gly Thr Thr Ala  
180 185 190  
His Thr Leu Asn Ser Phe Thr Ala Leu Val Ser Glu Ala Gly Phe Glu  
195 200 205  
Ile Leu Glu Val Thr Asp Leu Thr Ala Gln Thr Arg Cys Met Val Ser  
210 215 220  
Trp Tyr Val Asp Glu Leu Leu Arg Lys Leu Asp Glu Leu Ala Gly Val  
225 230 235 240  
Glu Pro Ala Ala Val Gly Thr Tyr Gln Gln Arg Tyr Leu Gly Asp Ile  
245 250 255  
Ala Ala Lys His Gly Pro Gly Pro Ala Gln Leu Ile Ala Ala Val Ala  
260 265 270  
Glu Tyr Arg Lys His Pro Asp Tyr Ala Arg Asn Glu Glu Ser Met Gly  
275 280 285  
Phe Met Leu Leu Gln Ala Arg Lys Lys Gln Ser  
290 295

<210> 21  
<211> 1167  
<212> DNA  
<213> Saccharopolyspora spinosa

<220>  
<221> CDS  
<222> (1)..(1164)  
<223> ORF8; cyclization enzyme

<400> 21  
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Met Ala Ser Glu His Ala Ser Leu Val Gly Asp Asp Leu Arg Ala Pro  
1 5 10 15  
gcg gat gat ccc ttc tac cga ccg ccg acg ccg cta ccg ccg ggt gtc 96  
Ala Asp Asp Pro Phe Tyr Arg Pro Pro Thr Pro Leu Pro Pro Gly Val  
20 25 30  
ccg ggc acg ctc ctc agg gcc ccg ccc gtc tcg gca ctg cgc ggc acg 144  
Pro Gly Thr Leu Leu Arg Ala Arg Pro Val Ser Ala Leu Arg Gly Thr  
35 40 45  
ggc gaa ccc gtc gca gcc aag gcc tgg caa atc ctc tac cgg tcc aac 192

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Gly	Glu	Pro	Val	Ala	Ala	Lys	Ala	Trp	Gln	Ile	Leu	Tyr	Arg	Ser	Asn	
	50					55					60					
tcc	gcc	ctt	ggc	atg	ccg	aac	gcc	gtc	tcc	ggc	acc	gtt	ctg	gtg	ccg	240
Ser	Ala	Leu	Gly	Met	Pro	Asn	Ala	Val	Ser	Gly	Thr	Val	Leu	Val	Pro	
65					70					75					80	
aac	atc	ccg	tgg	ccg	cgc	gaa	gat	cgc	ccc	atc	atc	act	ttc	gca	gtg	288
Asn	Ile	Pro	Trp	Pro	Arg	Glu	Asp	Arg	Pro	Ile	Ile	Thr	Phe	Ala	Val	
				85					90					95		
ggc	acc	cac	ggc	ctc	ggc	agc	caa	gtt	gcc	ccg	tcg	tac	ctg	ctt	cga	336
Gly	Thr	His	Gly	Leu	Gly	Ser	Gln	Val	Ala	Pro	Ser	Tyr	Leu	Leu	Arg	
			100					105					110			
acc	gga	acc	gag	ccg	gag	acc	gag	ctg	atc	gcc	gtg	gcc	ctc	gac	cgc	384
Thr	Gly	Thr	Glu	Pro	Glu	Thr	Glu	Leu	Ile	Ala	Val	Ala	Leu	Asp	Arg	
			115				120					125				
ggg	tgg	gcc	gtg	gtc	atc	acc	gac	tac	gaa	ggc	ctc	ggc	act	cct	gga	432
Gly	Trp	Ala	Val	Val	Ile	Thr	Asp	Tyr	Glu	Gly	Leu	Gly	Thr	Pro	Gly	
	130					135					140					
acc	cac	acc	tac	acc	gtc	ggc	agg	gcg	cag	gga	cac	gcc	atg	ctc	gat	480
Thr	His	Thr	Tyr	Thr	Val	Gly	Arg	Ala	Gln	Gly	His	Ala	Met	Leu	Asp	
145					150					155					160	
gcc	gcc	cgc	gct	gcg	caa	cgg	cta	ccg	ggc	tcc	ggc	ctg	acg	acc	gac	528
Ala	Ala	Arg	Ala	Ala	Gln	Arg	Leu	Pro	Gly	Ser	Gly	Leu	Thr	Thr	Asp	
				165					170					175		
tgc	ccg	gtc	ggc	atc	tgg	ggc	tat	gcg	cag	ggc	ggg	caa	gcg	tcg	gcc	576
Cys	Pro	Val	Gly	Ile	Trp	Gly	Tyr	Ala	Gln	Gly	Gly	Gln	Ala	Ser	Ala	
			180					185					190			
ttc	gcc	ggc	gaa	ctg	cac	ccc	acc	tac	gca	cct	gaa	ctg	cga	atc	cgc	624
Phe	Ala	Gly	Glu	Leu	His	Pro	Thr	Tyr	Ala	Pro	Glu	Leu	Arg	Ile	Arg	
		195					200					205				
gct	gcg	gcc	gca	ggc	gcg	gtg	ccg	atc	gat	ctg	ctg	gac	atc	atc	cac	672
Ala	Ala	Ala	Ala	Gly	Ala	Val	Pro	Ile	Asp	Leu	Leu	Asp	Ile	Ile	His	
	210					215					220					
cga	aac	gac	ggg	gtg	ttc	acc	ggg	ccg	gtg	ctg	gcc	ggc	ctg	gtc	ggg	720
Arg	Asn	Asp	Gly	Val	Phe	Thr	Gly	Pro	Val	Leu	Ala	Gly	Leu	Val	Gly	
225					230					235					240	
cat	gcc	gct	gcc	tac	ccc	gat	ctg	cca	ttc	gac	gag	ctt	ctc	acc	gaa	768
His	Ala	Ala	Ala	Tyr	Pro	Asp	Leu	Pro	Phe	Asp	Glu	Leu	Leu	Thr	Glu	
				245					250					255		
gcg	ggc	cgt	acc	gcc	gtt	gat	caa	gtg	cgc	gag	ctc	ggc	gca	ccg	gag	816
Ala	Gly	Arg	Thr	Ala	Val	Asp	Gln	Val	Arg	Glu	Leu	Gly	Ala	Pro	Glu	
			260					265					270			
ctc	gtc	acc	cgc	ttc	ctc	ggc	cgc	gag	ctg	agc	gac	ttc	ctc	gac	act	864
Leu	Val	Thr	Arg	Phe	Leu	Gly	Arg	Glu	Leu	Ser	Asp	Phe	Leu	Asp	Thr	
		275				280						285				
tcc	ggc	ctt	ttc	gag	caa	cct	cga	tgg	cgc	gca	cga	ctg	gcc	gaa	agc	912
Ser	Gly	Leu	Phe	Glu	Gln	Pro	Arg	Trp	Arg	Ala	Arg	Leu	Ala	Glu	Ser	
	290					295					300					

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gtc gca ggt agg aac ggt ggc ccg gtg gtc ccc acg ctc gtc tac cac	960
Val Ala Gly Arg Asn Gly Gly Pro Val Val Pro Thr Leu Val Tyr His	
305 310 315 320	
agc acg gac gac gag atc gtt ccg ttc gca ttc ggc gag cga ctc cgg	1008
Ser Thr Asp Asp Glu Ile Val Pro Phe Ala Phe Gly Glu Arg Leu Arg	
325 330 335	
gac agc tac cgc gcg gcg ggt acg cca gtg cgg tgg cat ccg ctc tcc	1056
Asp Ser Tyr Arg Ala Ala Gly Thr Pro Val Arg Trp His Pro Leu Ser	
340 345 350	
gga ttg gct cac ttt ccc gcc gcc ctg gcc agc tcg cga gtg gtc gtc	1104
Gly Leu Ala His Phe Pro Ala Ala Leu Ala Ser Ser Arg Val Val Val	
355 360 365	
tcg tgg ttc gac gag cac ttc tcc gag ccg tcc gcg atc agc ggt ccg	1152
Ser Trp Phe Asp Glu His Phe Ser Glu Pro Ser Ala Ile Ser Gly Pro	
370 375 380	
cga gat gcc agg tga	1167
Arg Asp Ala Arg	
385	

<210> 22  
 <211> 388  
 <212> PRT  
 <213> Saccharopolyspora spinosa

<400> 22  
 Met Ala Ser Glu His Ala Ser Leu Val Gly Asp Asp Leu Arg Ala Pro  
 1 5 10 15  
 Ala Asp Asp Pro Phe Tyr Arg Pro Pro Thr Pro Leu Pro Pro Gly Val  
 20 25 30  
 Pro Gly Thr Leu Leu Arg Ala Arg Pro Val Ser Ala Leu Arg Gly Thr  
 35 40 45  
 Gly Glu Pro Val Ala Ala Lys Ala Trp Gln Ile Leu Tyr Arg Ser Asn  
 50 55 60  
 Ser Ala Leu Gly Met Pro Asn Ala Val Ser Gly Thr Val Leu Val Pro  
 65 70 75 80  
 Asn Ile Pro Trp Pro Arg Glu Asp Arg Pro Ile Ile Thr Phe Ala Val  
 85 90 95  
 Gly Thr His Gly Leu Gly Ser Gln Val Ala Pro Ser Tyr Leu Leu Arg  
 100 105 110  
 Thr Gly Thr Glu Pro Glu Thr Glu Leu Ile Ala Val Ala Leu Asp Arg  
 115 120 125  
 Gly Trp Ala Val Val Ile Thr Asp Tyr Glu Gly Leu Gly Thr Pro Gly  
 130 135 140  
 Thr His Thr Tyr Thr Val Gly Arg Ala Gln Gly His Ala Met Leu Asp  
 145 150 155 160  
 Ala Ala Arg Ala Ala Gln Arg Leu Pro Gly Ser Gly Leu Thr Thr Asp  
 165 170 175



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Cys Pro Val Gly Ile Trp Gly Tyr Ala Gln Gly Gly Gln Ala Ser Ala  
180 185 190  
Phe Ala Gly Glu Leu His Pro Thr Tyr Ala Pro Glu Leu Arg Ile Arg  
195 200 205  
Ala Ala Ala Ala Gly Ala Val Pro Ile Asp Leu Leu Asp Ile Ile His  
210 215 220  
Arg Asn Asp Gly Val Phe Thr Gly Pro Val Leu Ala Gly Leu Val Gly  
225 230 235 240  
His Ala Ala Ala Tyr Pro Asp Leu Pro Phe Asp Glu Leu Leu Thr Glu  
245 250 255  
Ala Gly Arg Thr Ala Val Asp Gln Val Arg Glu Leu Gly Ala Pro Glu  
260 265 270  
Leu Val Thr Arg Phe Leu Gly Arg Glu Leu Ser Asp Phe Leu Asp Thr  
275 280 285  
Ser Gly Leu Phe Glu Gln Pro Arg Trp Arg Ala Arg Leu Ala Glu Ser  
290 295 300  
Val Ala Gly Arg Asn Gly Gly Pro Val Val Pro Thr Leu Val Tyr His  
305 310 315 320  
Ser Thr Asp Asp Glu Ile Val Pro Phe Ala Phe Gly Glu Arg Leu Arg  
325 330 335  
Asp Ser Tyr Arg Ala Ala Gly Thr Pro Val Arg Trp His Pro Leu Ser  
340 345 350  
Gly Leu Ala His Phe Pro Ala Ala Leu Ala Ser Ser Arg Val Val Val  
355 360 365  
Ser Trp Phe Asp Glu His Phe Ser Glu Pro Ser Ala Ile Ser Gly Pro  
370 375 380  
Arg Asp Ala Arg  
385

<210> 23  
<211> 1011  
<212> DNA  
<213> Saccharopolyspora spinosa

<220>  
<221> CDS  
<222> (1)..(1008)  
<223> ORF9; 2,3-reductase

<400> 23  
atg acc agc tcg atg cga aag ccg gtg cgc atc ggt gtg ctc ggg tgc 48  
Met Thr Ser Ser Met Arg Lys Pro Val Arg Ile Gly Val Leu Gly Cys  
1 5 10 15  
gct tcc ttc gcg tgg cga cgg atg ctg ccc gcg atg tgc gac gtg gcc 96  
Ala Ser Phe Ala Trp Arg Arg Met Leu Pro Ala Met Cys Asp Val Ala  
20 25 30

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gaa Glu	aca Thr	gag Glu 35	gtg Val	gtg Val	gcg Ala	gtg Val	gcg Ala 40	agc Ser	cgt Arg	gat Asp	ccg Pro	gcg Ala 45	aaa Lys	gcc Ala	gaa Glu	144
cgg Arg	ttc Phe 50	gca Ala	gcg Ala	cga Arg	ttc Phe	gaa Glu 55	tgc Cys	gag Glu	gcg Ala	gtg Val	ctg Leu 60	ggt Gly	tac Tyr	cag Gln	cgg Arg	192
ctc Leu 65	ctg Leu	gag Glu	cgg Arg	ccg Pro	gac Asp 70	atc Ile	gat Asp	gcc Ala	gtc Val	tac Tyr 75	gtg Val	ccg Pro	ttg Leu	ccg Pro	cct Pro 80	240
ggc Gly	atg Met	cat His	gca Ala	gag Glu 85	tgg Trp	atc Ile	ggc Gly	aag Lys	gcg Ala 90	ctt Leu	gag Glu	gca Ala	gac Asp	aaa Lys 95	cac His	288
gtg Val	ctt Leu	gcg Ala	gag Glu 100	aaa Lys	ccg Pro	ctg Leu	acg Thr 105	acg Thr	acg Thr	gcg Ala	tcc Ser	gac Asp 110	acc Thr	gct Ala	cgc Arg	336
ctg Leu	gtc Val	ggg Gly 115	ctg Leu	gcc Ala	agg Arg	agg Arg	aag Lys 120	aac Asn	ctg Leu	ctg Leu	ctg Leu	cgg Arg 125	gag Glu	aat Asn	tac Tyr	384
ctg Leu 130	ttc Phe	ctc Leu	cac His	cac His	ggc Gly	cgg Arg 135	cac His	gac Asp	gtg Val	gtc Val	cgc Arg 140	gac Asp	ctg Leu	ctg Leu	caa Gln	432
tcc Ser 145	ggg Gly	gag Glu	atc Ile	ggt Gly	gag Glu 150	ctc Leu	cgg Arg	gag Glu	ttc Phe 155	acc Thr 155	gcc Ala	gtg Val	ttc Phe	gga Gly	att Ile 160	480
ccg Pro	ccg Pro	ctt Leu	ccc Pro	gac Asp 165	acg Thr	gac Asp	atc Ile	cgc Arg	tat Tyr 170	cgc Arg	acc Thr	gaa Glu	ctc Leu	ggt Gly 175	ggc Gly	528
gga Gly	gcg Ala	ttg Leu	ctg Leu 180	gac Asp	atc Ile	ggt Gly	gtc Val	tat Tyr 185	ccc Pro	gcc Ala	cgt Arg	gcc Ala	gct Ala 190	cgg Arg	cac His	576
ttt Phe	ctc Leu	ctc Leu 195	ggt Gly	ccg Pro	ctc Leu	acg Thr	gtt Val 200	ctc Leu	ggc Gly	gca Ala	agc Ser 205	tcg Ser 205	cac His	gag Glu	gcc Ala	624
cag Gln 210	gag Glu	tcg Ser	ggc Gly	gtc Val	gac Asp	ttg Leu 215	tcg Ser	ggc Gly	agc Ser	gtg Val	ctg Leu 220	ctc Leu	caa Gln	tcg Ser	gaa Glu	672
ggt Gly 225	ggc Gly	acc Thr	gtt Val	gcc Ala	cac His 230	ctc Leu	gga Gly	tac Tyr	ggt Gly	ttc Phe 235	gtg Val	cac His	cac His	tac Tyr	cgc Arg 240	720
agc Ser	gcg Ala	tac Tyr	gag Glu	ctg Leu 245	tgg Trp	ggg Gly	agt Ser	cgt Arg	ggg Gly 250	cga Arg	atc Ile	gtc Val	gtc Val	gac Asp 255	cgg Arg	768
gcg Ala	ttc Phe	acg Thr	ccg Pro 260	ccc Pro	gcc Ala	gag Glu	tgg Trp	cag Gln 265	gcc Ala	gtg Val	atc Ile	cga Arg	atc Ile 270	gag Glu	cgg Arg	816
aag Lys	ggc Gly	gtt Val	gtc Val	gac Asp	gag Glu	ttg Leu	tcc Ser	ttg Leu	cca Pro	gcg Ala	gaa Glu	gat Asp	cag Gln	gtt Val	cgc Arg	864

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275	280	285	
aag gcg gtc acc gcc ttc gca cgc gac atc aga gca ggg aca ggc gtg			912
Lys Ala Val Thr Ala Phe Ala Arg Asp Ile Arg Ala Gly Thr Gly Val			
290	295	300	
gac gac cct gcg gtg gcc gga gat tcg ggc gaa tcg atg atc cag cag			960
Asp Asp Pro Ala Val Ala Gly Asp Ser Gly Glu Ser Met Ile Gln Gln			
305	310	315	320
gcc gcg ctg gtg gag gcg atc ggt cag gcc cgt cgg tgc ggg tcc aca			1008
Ala Ala Leu Val Glu Ala Ile Gly Gln Ala Arg Arg Cys Gly Ser Thr			
325	330	335	
tag			1011

<210> 24

<211> 336

<212> PRT

<213> Saccharopolyspora spinosa

<400> 24

Met Thr Ser Ser Met Arg Lys Pro Val Arg Ile Gly Val Leu Gly Cys	
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Ala Ser Phe Ala Trp Arg Arg Met Leu Pro Ala Met Cys Asp Val Ala	
20 25 30	
Glu Thr Glu Val Val Ala Val Ala Ser Arg Asp Pro Ala Lys Ala Glu	
35 40 45	
Arg Phe Ala Ala Arg Phe Glu Cys Glu Ala Val Leu Gly Tyr Gln Arg	
50 55 60	
Leu Leu Glu Arg Pro Asp Ile Asp Ala Val Tyr Val Pro Leu Pro Pro	
65 70 75 80	
Gly Met His Ala Glu Trp Ile Gly Lys Ala Leu Glu Ala Asp Lys His	
85 90 95	
Val Leu Ala Glu Lys Pro Leu Thr Thr Thr Ala Ser Asp Thr Ala Arg	
100 105 110	
Leu Val Gly Leu Ala Arg Arg Lys Asn Leu Leu Leu Arg Glu Asn Tyr	
115 120 125	
Leu Phe Leu His His Gly Arg His Asp Val Val Arg Asp Leu Leu Gln	
130 135 140	
Ser Gly Glu Ile Gly Glu Leu Arg Glu Phe Thr Ala Val Phe Gly Ile	
145 150 155 160	
Pro Pro Leu Pro Asp Thr Asp Ile Arg Tyr Arg Thr Glu Leu Gly Gly	
165 170 175	
Gly Ala Leu Leu Asp Ile Gly Val Tyr Pro Ala Arg Ala Ala Arg His	
180 185 190	
Phe Leu Leu Gly Pro Leu Thr Val Leu Gly Ala Ser Ser His Glu Ala	
195 200 205	
Gln Glu Ser Gly Val Asp Leu Ser Gly Ser Val Leu Leu Gln Ser Glu	

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210	215	220	
Gly 225	Gly Thr Val Ala His 230	Leu Gly Tyr Gly Phe Val His His Tyr Arg 240	
Ser Ala Tyr Glu 245	Leu Trp Gly Ser Arg 250	Gly Arg Ile Val Val Asp Arg 255	
Ala Phe Thr 260	Pro Ala Glu Trp Gln 265	Ala Val Ile Arg Ile Glu Arg 270	
Lys Gly Val 275	Val Asp Glu Leu Ser 280	Leu Pro Ala Glu Asp Gln Val Arg 285	
Lys Ala Val 290	Thr Ala Phe Ala Arg Asp Ile Arg 300	Ala Gly Thr Gly Val 305	
Asp Asp Pro Ala Val 310	Ala Gly Asp Ser Gly Glu Ser Met Ile Gln Gln 320		
Ala Ala Leu Val 325	Glu Ala Ile Gly Gln Ala Arg Arg Cys Gly Ser Thr 335		

<210> 25  
 <211> 1461  
 <212> DNA  
 <213> Saccharopolyspora spinosa

<220>  
 <221> CDS  
 <222> (1)..(1458)  
 <223> ORF10; 2,3-dehydratase

<400> 25

atg agc agt tct gtc gaa gct gag gca agt gct gct gcg ccg ctc ggc	48
Met Ser Ser Ser Val Glu Ala Glu Ala Ser Ala Ala Ala Pro Leu Gly	
1 5 10 15	
agc aac aac acg cgg cgg ttc gtc gac tct gcg ctg agc gct tgc aat	96
Ser Asn Asn Thr Arg Arg Phe Val Asp Ser Ala Leu Ser Ala Cys Asn	
20 25 30	
ggc atg att ccg acc acg gag ttc cac tgc tgg ctc gcc gat cgg ctg	144
Gly Met Ile Pro Thr Thr Glu Phe His Cys Trp Leu Ala Asp Arg Leu	
35 40 45	
ggc gag aac agc ttc gag acc aat cgc atc ccg ttc gac cgc ctg tcg	192
Gly Glu Asn Ser Phe Glu Thr Asn Arg Ile Pro Phe Asp Arg Leu Ser	
50 55 60	
aaa tgg aaa ttc gat gcc agc acg gag aac ctg gtt cat gcc gac ggt	240
Lys Trp Lys Phe Asp Ala Ser Thr Glu Asn Leu Val His Ala Asp Gly	
65 70 75 80	
agg ttc ttc acg gta gaa ggc ctg cag gtc gag acc aac tat ggc gcg	288
Arg Phe Phe Thr Val Glu Gly Leu Gln Val Glu Thr Asn Tyr Gly Ala	
85 90 95	
gca ccc agc tgg cac cag ccg atc atc aac cag gct gaa gta ggt atc	336
Ala Pro Ser Trp His Gln Pro Ile Ile Asn Gln Ala Glu Val Gly Ile	
100 105 110	

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ctc	ggc	att	ctc	gtc	aag	gag	atc	gac	ggc	gtg	ctg	cac	tgc	ctc	atg	384
Leu	Gly	Ile	Leu	Val	Lys	Glu	Ile	Asp	Gly	Val	Leu	His	Cys	Leu	Met	
		115					120					125				
tca	gca	aag	atg	gaa	ccg	ggc	aac	gtc	aac	gtc	ctg	cag	ctc	tcg	ccg	432
Ser	Ala	Lys	Met	Glu	Pro	Gly	Asn	Val	Asn	Val	Leu	Gln	Leu	Ser	Pro	
	130					135					140					
acg	gtt	cag	gca	act	cgg	agc	aac	tac	acg	cag	gca	cac	cgt	ggc	agc	480
Thr	Val	Gln	Ala	Thr	Arg	Ser	Asn	Tyr	Thr	Gln	Ala	His	Arg	Gly	Ser	
145					150					155					160	
gtt	ccg	ccc	tat	gtg	gac	tac	ttc	ctc	ggg	cgg	ggc	cgc	ggc	cgc	gtg	528
Val	Pro	Pro	Tyr	Val	Asp	Tyr	Phe	Leu	Gly	Arg	Gly	Arg	Gly	Arg	Val	
				165					170					175		
ctg	gta	gac	gtg	ctc	cag	tct	gaa	cag	ggg	tcc	tgg	ttc	tac	cgg	aag	576
Leu	Val	Asp	Val	Leu	Gln	Ser	Glu	Gln	Gly	Ser	Trp	Phe	Tyr	Arg	Lys	
			180					185					190			
cgc	aac	cgg	aac	atg	gtg	gtg	gaa	gtc	cag	gag	gaa	gtg	cca	gtc	ctg	624
Arg	Asn	Arg	Asn	Met	Val	Val	Glu	Val	Gln	Glu	Glu	Val	Pro	Val	Leu	
		195					200					205				
cca	gac	ttc	tgc	tgg	ttg	acg	ctc	ggc	cag	gtg	ctg	gct	ctc	ctt	cgt	672
Pro	Asp	Phe	Cys	Trp	Leu	Thr	Leu	Gly	Gln	Val	Leu	Ala	Leu	Leu	Arg	
	210					215					220					
cag	gac	aac	atc	gtc	aac	atg	gac	acc	cgg	acg	gtg	ctg	tct	tgc	atc	720
Gln	Asp	Asn	Ile	Val	Asn	Met	Asp	Thr	Arg	Thr	Val	Leu	Ser	Cys	Ile	
225					230					235					240	
ccg	ttc	cac	gat	tcc	gcc	acc	gga	ccc	gaa	cta	gcc	gcc	tcg	gag	gag	768
Pro	Phe	His	Asp	Ser	Ala	Thr	Gly	Pro	Glu	Leu	Ala	Ala	Ser	Glu	Glu	
				245					250					255		
ccc	ttc	cga	cag	gcg	gtg	gcc	agg	tcg	ctc	tcg	cac	ggc	atc	gat	tcg	816
Pro	Phe	Arg	Gln	Ala	Val	Ala	Arg	Ser	Leu	Ser	His	Gly	Ile	Asp	Ser	
			260					265					270			
tcg	agt	atc	tcc	gag	gcg	gtc	ggc	tgg	ttc	gag	gaa	gcc	aag	gcc	cgc	864
Ser	Ser	Ile	Ser	Glu	Ala	Val	Gly	Trp	Phe	Glu	Glu	Ala	Lys	Ala	Arg	
		275					280					285				
tac	cgc	ttg	cgg	gca	acg	cgc	gtt	ccg	ctg	agc	agg	gtc	gac	aag	tgg	912
Tyr	Arg	Leu	Arg	Ala	Thr	Arg	Val	Pro	Leu	Ser	Arg	Val	Asp	Lys	Trp	
	290					295					300					
tat	cgc	acc	gat	acc	gag	atc	gcc	cac	cag	gac	ggc	aag	tac	ttc	gcg	960
Tyr	Arg	Thr	Asp	Thr	Glu	Ile	Ala	His	Gln	Asp	Gly	Lys	Tyr	Phe	Ala	
305					310					315					320	
gtg	atc	gcg	gtg	tcg	gtg	tcc	gcg	acc	aat	cgt	gag	gtc	gcc	agc	tgg	1008
Val	Ile	Ala	Val	Ser	Val	Ser	Ala	Thr	Asn	Arg	Glu	Val	Ala	Ser	Trp	
				325					330					335		
acg	cag	ccg	atg	atc	gaa	ccg	cga	gaa	caa	ggc	gag	atc	gca	ctg	ttg	1056
Thr	Gln	Pro	Met	Ile	Glu	Pro	Arg	Glu	Gln	Gly	Glu	Ile	Ala	Leu	Leu	
			340					345					350			
gtc	aag	cgg	atc	ggc	gga	gtg	ctg	cac	ggc	ttg	gtc	cac	gct	cgg	gtg	1104
Val	Lys	Arg	Ile	Gly	Gly	Val	Leu	His	Gly	Leu	Val	His	Ala	Arg	Val	

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355					360					365						
gag	gct	ggg	tat	aag	tgg	act	gcg	gaa	atc	gct	ccc	acg	gtc	cag	tgc	1152
Glu	Ala	Gly	Tyr	Lys	Trp	Thr	Ala	Glu	Ile	Ala	Pro	Thr	Val	Gln	Cys	
	370					375					380					
agt	gtg	gcc	aac	tac	caa	agc	acc	ccg	tcg	aac	gac	tgg	ccg	ccg	ttc	1200
Ser	Val	Ala	Asn	Tyr	Gln	Ser	Thr	Pro	Ser	Asn	Asp	Trp	Pro	Pro	Phe	
385					390					395					400	
ttg	gac	gac	gtg	ctc	acc	gcc	gat	ccc	gaa	acc	gtg	cgg	tac	gaa	tcg	1248
Leu	Asp	Asp	Val	Leu	Thr	Ala	Asp	Pro	Glu	Thr	Val	Arg	Tyr	Glu	Ser	
				405					410					415		
atc	ctg	tcc	gaa	gaa	ggc	ggg	cgg	ttc	tac	cag	gcg	cag	aac	agg	tac	1296
Ile	Leu	Ser	Glu	Glu	Gly	Gly	Arg	Phe	Tyr	Gln	Ala	Gln	Asn	Arg	Tyr	
			420				425						430			
cgg	atc	atc	gag	gtg	cat	gag	gac	ttc	gcg	gca	cga	cct	ccc	agc	gac	1344
Arg	Ile	Ile	Glu	Val	His	Glu	Asp	Phe	Ala	Ala	Arg	Pro	Pro	Ser	Asp	
		435					440					445				
ttc	cgg	tgg	atg	act	ttg	gga	cag	ttg	ggc	gag	ctg	ctc	cgg	agc	acc	1392
Phe	Arg	Trp	Met	Thr	Leu	Gly	Gln	Leu	Gly	Glu	Leu	Leu	Arg	Ser	Thr	
	450					455					460					
cac	ttc	ttg	aac	atc	cag	gcg	cgc	agc	ttg	gtc	gcc	tcc	ctg	cat	agc	1440
His	Phe	Leu	Asn	Ile	Gln	Ala	Arg	Ser	Leu	Val	Ala	Ser	Leu	His	Ser	
465					470					475					480	
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				485												

<210> 26

<211> 486

<212> PRT

<213> Saccharopolyspora spinosa

<400> 26

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			20					25					30		
Gly	Met	Ile	Pro	Thr	Thr	Glu	Phe	His	Cys	Trp	Leu	Ala	Asp	Arg	Leu
		35					40					45			
Gly	Glu	Asn	Ser	Phe	Glu	Thr	Asn	Arg	Ile	Pro	Phe	Asp	Arg	Leu	Ser
	50					55					60				
Lys	Trp	Lys	Phe	Asp	Ala	Ser	Thr	Glu	Asn	Leu	Val	His	Ala	Asp	Gly
65					70					75					80
Arg	Phe	Phe	Thr	Val	Glu	Gly	Leu	Gln	Val	Glu	Thr	Asn	Tyr	Gly	Ala
				85					90					95	
Ala	Pro	Ser	Trp	His	Gln	Pro	Ile	Ile	Asn	Gln	Ala	Glu	Val	Gly	Ile
			100					105					110		
Leu	Gly	Ile	Leu	Val	Lys	Glu	Ile	Asp	Gly	Val	Leu	His	Cys	Leu	Met

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Thr	Val	Gln	Ala	Thr	Arg	Ser	Asn	Tyr	Thr	Gln	Ala	His	Arg	Gly	Ser
145					150					155					160
Val	Pro	Pro	Tyr	Val	Asp	Tyr	Phe	Leu	Gly	Arg	Gly	Arg	Gly	Arg	Val
				165					170					175	
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			180					185					190		
Arg	Asn	Arg	Asn	Met	Val	Val	Glu	Val	Gln	Glu	Glu	Val	Pro	Val	Leu
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Pro	Asp	Phe	Cys	Trp	Leu	Thr	Leu	Gly	Gln	Val	Leu	Ala	Leu	Leu	Arg
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Gln	Asp	Asn	Ile	Val	Asn	Met	Asp	Thr	Arg	Thr	Val	Leu	Ser	Cys	Ile
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Pro	Phe	His	Asp	Ser	Ala	Thr	Gly	Pro	Glu	Leu	Ala	Ala	Ser	Glu	Glu
				245					250					255	
Pro	Phe	Arg	Gln	Ala	Val	Ala	Arg	Ser	Leu	Ser	His	Gly	Ile	Asp	Ser
			260					265					270		
Ser	Ser	Ile	Ser	Glu	Ala	Val	Gly	Trp	Phe	Glu	Glu	Ala	Lys	Ala	Arg
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Tyr	Arg	Leu	Arg	Ala	Thr	Arg	Val	Pro	Leu	Ser	Arg	Val	Asp	Lys	Trp
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Tyr	Arg	Thr	Asp	Thr	Glu	Ile	Ala	His	Gln	Asp	Gly	Lys	Tyr	Phe	Ala
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Val	Ile	Ala	Val	Ser	Val	Ser	Ala	Thr	Asn	Arg	Glu	Val	Ala	Ser	Trp
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Thr	Gln	Pro	Met	Ile	Glu	Pro	Arg	Glu	Gln	Gly	Glu	Ile	Ala	Leu	Leu
			340					345					350		
Val	Lys	Arg	Ile	Gly	Gly	Val	Leu	His	Gly	Leu	Val	His	Ala	Arg	Val
		355					360					365			
Glu	Ala	Gly	Tyr	Lys	Trp	Thr	Ala	Glu	Ile	Ala	Pro	Thr	Val	Gln	Cys
	370					375					380				
Ser	Val	Ala	Asn	Tyr	Gln	Ser	Thr	Pro	Ser	Asn	Asp	Trp	Pro	Pro	Phe
385					390					395					400
Leu	Asp	Asp	Val	Leu	Thr	Ala	Asp	Pro	Glu	Thr	Val	Arg	Tyr	Glu	Ser
				405					410					415	
Ile	Leu	Ser	Glu	Glu	Gly	Gly	Arg	Phe	Tyr	Gln	Ala	Gln	Asn	Arg	Tyr
			420					425					430		
Arg	Ile	Ile	Glu	Val	His	Glu	Asp	Phe	Ala	Ala	Arg	Pro	Pro	Ser	Asp
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Phe	Arg	Trp	Met	Thr	Leu	Gly	Gln	Leu	Gly	Glu	Leu	Leu	Arg	Ser	Thr



[illegible]

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 <212> PRT  
 <213> Saccharopolyspora spinosa

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 35 40 45  
 Leu Ile Ser Pro Glu Val Cys Ala Pro Thr Asp Phe Arg Arg Gly Ser  
 50 55 60  
 Trp Arg Pro Leu Ser Asn Asp Tyr Arg Ala Val Glu Thr Tyr Arg Cys  
 65 70 75 80  
 Ala Pro Gly Ala Lys Val Gly Cys Pro Ile Thr Val Leu Val Val Asp  
 85 90 95  
 Ala Glu Pro Lys Val Thr Leu Asp Glu Ala Glu Ala Trp Arg Glu His  
 100 105 110  
 Thr Glu Ala Val Ala Asp Val Arg Val Phe Ser Gly Gly His Phe Phe  
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 130 135 140  
 Leu Arg  
 145

<210> 29  
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 <213> Saccharopolyspora spinosa

<220>  
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 <222> (1)..(1317)  
 <223> ORF12; glycosyltransferase

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 ctg gtg ccg ttg gcg tgg gcg ttg cgt gcc gcg ggg cac gag gtc cgt 96  
 Leu Val Pro Leu Ala Trp Ala Leu Arg Ala Ala Gly His Glu Val Arg  
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 gtc gcc atc tgc ccg aat atg gtg tcg atg gtc acc gga gca gga ctc 144  
 Val Ala Ile Cys Pro Asn Met Val Ser Met Val Thr Gly Ala Gly Leu  
 35 40 45  
 acc gcg gtt ccc gtc ggc gac gag ctc gac ctc atc tcc ttg gcg gcc 192  
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Thr	Ala	Val	Pro	Val	Gly	Asp	Glu	Leu	Asp	Leu	Ile	Ser	Leu	Ala	Ala		
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Lys	Asn	Glu	Leu	Val	Leu	Gly	Ser	Gly	Val	Ser	Phe	Asp	Glu	Lys	Gly		
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cgg	cat	ccg	gaa	ctc	ttc	gac	gag	ctg	ctg	tca	atc	aac	tcc	ggc	aga	288	
Arg	His	Pro	Glu	Leu	Phe	Asp	Glu	Leu	Leu	Ser	Ile	Asn	Ser	Gly	Arg		
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gac	acg	gac	gcc	gtg	gag	caa	ctc	cac	ctt	gtg	gat	gac	cga	tcg	ctg	336	
Asp	Thr	Asp	Ala	Val	Glu	Gln	Leu	His	Leu	Val	Asp	Asp	Arg	Ser	Leu		
			100					105					110				
gac	gat	ctc	atg	ggg	ttc	gcc	gag	aaa	tgg	cag	cct	gat	ctc	gtt	gtg	384	
Asp	Asp	Leu	Met	Gly	Phe	Ala	Glu	Lys	Trp	Gln	Pro	Asp	Leu	Val	Val		
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tgg	gac	gct	atg	gtg	tgt	tcg	ggg	cca	gtt	gtg	gcg	cga	gcg	ctc	ggc	432	
Trp	Asp	Ala	Met	Val	Cys	Ser	Gly	Pro	Val	Val	Ala	Arg	Ala	Leu	Gly		
	130					135					140						
gca	cga	cac	gtg	cgg	atg	ctc	gtc	gcc	ctc	gat	gtg	tcg	ggg	tgg	ctg	480	
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Arg	Ser	Gly	Phe	Leu	Glu	Tyr	Gln	Glu	Ser	Lys	Pro	Pro	Glu	Gln	Arg		
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gtc	gac	ccg	ctc	ggg	acg	tgg	ctg	gga	gcg	aag	ctc	gcc	aag	ttc	gga	576	
Val	Asp	Pro	Leu	Gly	Thr	Trp	Leu	Gly	Ala	Lys	Leu	Ala	Lys	Phe	Gly		
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Ile	Pro	Ser	Trp	Met	Arg	Leu	Pro	Val	Asp	Leu	Asp	Tyr	Ile	Ser	Met		
	210					215					220						
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Arg	Arg	Leu	Ser	Arg	Val	Thr	Glu	Gln	Tyr	Gly	Glu	Gln	Ser	Asp	Gln		
			260					265					270				
gaa	caa	gca	atg	gtg	gaa	agg	ttg	ttg	cgc	ggc	gcg	gcc	agg	ctc	gac	864	
Glu	Gln	Ala	Met	Val	Glu	Arg	Leu	Leu	Arg	Gly	Ala	Ala	Arg	Leu	Asp		
		275					280					285					
gtc	gag	gtg	atc	gcc	acc	ttg	tct	gac	gac	gaa	gta	cgg	gag	atg	ggg	912	
Val	Glu	Val	Ile	Ala	Thr	Leu	Ser	Asp	Asp	Glu	Val	Arg	Glu	Met	Gly		
	290					295					300						

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Leu	Leu	Glu	Ser	Cys	Ser	Val	Ile	Ile	His	His	Gly	Ser	Thr	Thr	Thr	
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cag	gaa	acc	gcc	acg	gtc	aac	ggc	gta	ccg	cag	ttg	att	ctc	cct	ggg	1056
Gln	Glu	Thr	Ala	Thr	Val	Asn	Gly	Val	Pro	Gln	Leu	Ile	Leu	Pro	Gly	
			340					345					350			
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Thr	Phe	Trp	Asp	Glu	Ser	Arg	Arg	Ala	Glu	Leu	Leu	Ala	Asp	Arg	Gly	
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Ala	Gly	Leu	Val	Leu	Asp	Pro	Ala	Thr	Phe	Thr	Glu	Asp	Asp	Val	Arg	
	370					375					380					
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Gly	Gln	Leu	Ala	Arg	Leu	Leu	Asp	Glu	Pro	Ser	Phe	Ala	Ala	Asn	Ala	
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gcg	ctg	atc	cgc	cgt	gaa	atc	gag	gaa	agt	ccc	agc	ccg	cac	gac	atc	1248
Ala	Leu	Ile	Arg	Arg	Glu	Ile	Glu	Glu	Ser	Pro	Ser	Pro	His	Asp	Ile	
				405					410					415		
gtt	cca	cgt	ctg	gaa	aag	cta	gtt	gcc	gaa	cgt	gag	aac	cgc	cgc	act	1296
Val	Pro	Arg	Leu	Glu	Lys	Leu	Val	Ala	Glu	Arg	Glu	Asn	Arg	Arg	Thr	
			420					425					430			
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Gly	Gln	Ser	Asp	Gly	His	Pro										
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<210> 30  
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 <213> Saccharopolyspora spinosa

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 Val Ala Ile Cys Pro Asn Met Val Ser Met Val Thr Gly Ala Gly Leu  
 35 40 45  
 Thr Ala Val Pro Val Gly Asp Glu Leu Asp Leu Ile Ser Leu Ala Ala  
 50 55 60  
 Lys Asn Glu Leu Val Leu Gly Ser Gly Val Ser Phe Asp Glu Lys Gly  
 65 70 75 80  
 Arg His Pro Glu Leu Phe Asp Glu Leu Leu Ser Ile Asn Ser Gly Arg  
 85 90 95  
 Asp Thr Asp Ala Val Glu Gln Leu His Leu Val Asp Asp Arg Ser Leu  
 100 105 110

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Asp Asp Leu Met Gly Phe Ala Glu Lys Trp Gln Pro Asp Leu Val Val  
 115 120 125  
 Trp Asp Ala Met Val Cys Ser Gly Pro Val Val Ala Arg Ala Leu Gly  
 130 135 140  
 Ala Arg His Val Arg Met Leu Val Ala Leu Asp Val Ser Gly Trp Leu  
 145 150 155 160  
 Arg Ser Gly Phe Leu Glu Tyr Gln Glu Ser Lys Pro Pro Glu Gln Arg  
 165 170 175  
 Val Asp Pro Leu Gly Thr Trp Leu Gly Ala Lys Leu Ala Lys Phe Gly  
 180 185 190  
 Ala Thr Phe Asp Glu Glu Ile Val Thr Gly Gln Ala Thr Ile Asp Pro  
 195 200 205  
 Ile Pro Ser Trp Met Arg Leu Pro Val Asp Leu Asp Tyr Ile Ser Met  
 210 215 220  
 Arg Phe Val Pro Tyr Asn Gly Pro Ala Val Leu Pro Glu Trp Leu Arg  
 225 230 235 240  
 Glu Arg Pro Thr Lys Pro Arg Val Cys Ile Thr Arg Gly Leu Thr Lys  
 245 250 255  
 Arg Arg Leu Ser Arg Val Thr Glu Gln Tyr Gly Glu Gln Ser Asp Gln  
 260 265 270  
 Glu Gln Ala Met Val Glu Arg Leu Leu Arg Gly Ala Ala Arg Leu Asp  
 275 280 285  
 Val Glu Val Ile Ala Thr Leu Ser Asp Asp Glu Val Arg Glu Met Gly  
 290 295 300  
 Glu Leu Pro Ser Asn Val Arg Val His Glu Tyr Val Pro Leu Asn Glu  
 305 310 315 320  
 Leu Leu Glu Ser Cys Ser Val Ile Ile His His Gly Ser Thr Thr Thr  
 325 330 335  
 Gln Glu Thr Ala Thr Val Asn Gly Val Pro Gln Leu Ile Leu Pro Gly  
 340 345 350  
 Thr Phe Trp Asp Glu Ser Arg Arg Ala Glu Leu Leu Ala Asp Arg Gly  
 355 360 365  
 Ala Gly Leu Val Leu Asp Pro Ala Thr Phe Thr Glu Asp Asp Val Arg  
 370 375 380  
 Gly Gln Leu Ala Arg Leu Leu Asp Glu Pro Ser Phe Ala Ala Asn Ala  
 385 390 395 400  
 Ala Leu Ile Arg Arg Glu Ile Glu Glu Ser Pro Ser Pro His Asp Ile  
 405 410 415  
 Val Pro Arg Leu Glu Lys Leu Val Ala Glu Arg Glu Asn Arg Arg Thr  
 420 425 430  
 Gly Gln Ser Asp Gly His Pro  
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LeA33955-US

<210> 31  
 <211> 1389  
 <212> DNA  
 <213> Saccharopolyspora spinosa

<220>  
 <221> CDS  
 <222> (1)..(1386)  
 <223> ORF13; 3,4-dehydratase

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 Thr Ser Cys Asp Asp Thr Cys Ala Thr Ala Thr Glu Met Val Pro Asp  
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 gcc aag gac cgg ata ttg gca tcc gta cgc gat tac cac cgc gaa cag 144  
 Ala Lys Asp Arg Ile Leu Ala Ser Val Arg Asp Tyr His Arg Glu Gln  
 35 40 45  
 gaa tcc ccg acc ttc gtg gct gga tcg acg ccg atc cgg cca tcg ggc 192  
 Glu Ser Pro Thr Phe Val Ala Gly Ser Thr Pro Ile Arg Pro Ser Gly  
 50 55 60  
 gcc gtg ctc gac gag gac gac cgg gtg gca ctg gtg gaa gcc gcg ctg 240  
 Ala Val Leu Asp Glu Asp Asp Arg Val Ala Leu Val Glu Ala Ala Leu  
 65 70 75 80  
 gag ctc cgg atc gcc gcg ggc ggg aat gca cgg cga ttc gag agc gag 288  
 Glu Leu Arg Ile Ala Ala Gly Gly Asn Ala Arg Arg Phe Glu Ser Glu  
 85 90 95  
 ttc gcc cgc ttc ttc ggc ctc cgc aag gct cat ctc gtc aac tcc ggt 336  
 Phe Ala Arg Phe Phe Gly Leu Arg Lys Ala His Leu Val Asn Ser Gly  
 100 105 110  
 tcg tcg gcc aat ctc ctg gca ctg agt tcg ctt acc tcc ccc aaa ctc 384  
 Ser Ser Ala Asn Leu Leu Ala Leu Ser Ser Leu Thr Ser Pro Lys Leu  
 115 120 125  
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 Gly Glu Ala Arg Leu Arg Pro Gly Asp Glu Val Ile Thr Ala Ala Val  
 130 135 140  
 ggc ttc ccc acg acg atc aat ccg gcg gtc caa aac gga ctc gtc ccg 480  
 Gly Phe Pro Thr Thr Ile Asn Pro Ala Val Gln Asn Gly Leu Val Pro  
 145 150 155 160  
 gta ttc gtc gac gtg gaa ctg ggc acc tac aac gca acg cca gac cgc 528  
 Val Phe Val Asp Val Glu Leu Gly Thr Tyr Asn Ala Thr Pro Asp Arg  
 165 170 175  
 atc aag gcc gcc gtc acg gaa cgg acg cga gcc atc atg ctg gcg cac 576  
 Ile Lys Ala Ala Val Thr Glu Arg Thr Arg Ala Ile Met Leu Ala His  
 180 185 190  
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LeA33955-US																
Thr	Leu	Gly 195	Asn	Pro	Phe	Ala	Ala 200	Asp	Glu	Ile	Ala	Glu 205	Ile	Ala	Lys	
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acc Thr 225	tac Tyr	cgg Arg	gga Gly	cgg Arg	ctg Leu 230	acc Thr	gga Gly	acc Thr	ttc Phe	ggc Gly 235	gac Asp	ctg Leu	aca Thr	acg Thr	gtc Val 240	720
agc Ser	ttc Phe	tat Tyr	cct Pro	gcc Ala 245	cat His	cac His	atc Ile	acc Thr	agc Ser 250	ggc Gly	gag Glu	ggt Gly	ggc Gly	tgc Cys 255	gtg Val	768
ttg Leu	acc Thr	ggc Gly	agc Ser 260	ctg Leu	gaa Glu	ttg Leu	gct Ala	cgc Arg 265	atc Ile	atc Ile	gag Glu	tcg Ser	ctg Leu 270	cgt Arg	gac Asp	816
tgg Trp	gga Gly	cgg Arg 275	gat Asp	tgc Cys	tgg Trp	tgc Cys	gag Glu 280	ccc Pro	ggc Gly	gtg Val	gac Asp	aac Asn 285	acc Thr	tgc Cys	cgc Arg	864
aag Lys	agg Arg 290	ttc Phe	gac Asp	tac Tyr	cac His	ctc Leu 295	ggt Gly	acc Thr	ctt Leu	cca Pro	ccg Pro 300	ggc Gly	tac Tyr	gac Asp	cac His	912
aag Lys 305	tac Tyr	acg Thr	ttc Phe	tcc Ser	cac His 310	gtc Val	ggt Gly	tac Tyr	aac Asn	ctc Leu 315	aag Lys	acc Thr	acc Thr	gac Asp	ctg Leu 320	960
cag Gln	gcc Ala	gca Ala	ctt Leu	gcg Ala 325	ctg Leu	agc Ser	cag Gln	ttg Leu	agc Ser 330	aag Lys	att Ile	tcc Ser	gca Ala	ttc Phe 335	ggg Gly	1008
tcg Ser	gca Ala	cgc Arg	cgc Arg 340	cgt Arg	aac Asn	tgg Trp	cga Arg	cgg Arg 345	ttg Leu	cgc Arg	gaa Glu	ggg Gly 350	ctg Leu	tcc Ser	ggg Gly	1056
ttg Leu	ccg Pro	ggc Gly 355	ctg Leu	ctg Leu	ctg Leu	ccg Pro	gta Val 360	gcc Ala	aca Thr	ccg Pro	cac His	agc Ser 365	gac Asp	ccg Pro	agc Ser	1104
tgg Trp	ttc Phe 370	ggg Gly	ttt Phe	gcg Ala	atc Ile	acc Thr 375	atc Ile	agt Ser	gcg Ala	gac Asp	gcc Ala 380	ggg Gly	ttc Phe	acc Thr	cgt Arg	1152
gcc Ala 385	gcc Ala	ctg Leu	gtg Val	aac Asn	ttc Phe 390	ctg Leu	gaa Glu	tcc Ser	cgc Arg	aac Asn 395	atc Ile	ggc Gly	acc Thr	cga Arg	ctg Leu 400	1200
ctg Leu	ttc Phe	ggc Gly	ggt Gly	aac Asn 405	atc Ile	acc Thr	cgg Arg	cac His	ccg Pro 410	gcc Ala	ttc Phe	gag Glu	cag Gln	gtg Val 415	cgg Arg	1248
tac Tyr	cgg Arg	atc Ile	gcc Ala 420	gac Asp	gcg Ala	ctc Leu	acc Thr	aac Asn 425	agc Ser	gac Asp	atc Ile	gtc Val	acc Thr 430	gac Asp	cga Arg	1296
acc Thr	ttc Phe	tgg Trp 435	gtc Val	ggc Gly	gtc Val	tac Tyr	cca Pro 440	ggc Gly	ata Ile	acg Thr	gac Asp	caa Gln 445	atg Met	atc Ile	gac Asp	1344



## LeA33955-US

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 450 455 460

1389

&lt;210&gt; 32

&lt;211&gt; 462

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 32

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Thr Ser Cys Asp Asp Thr Cys Ala Thr Ala Thr Glu Met Val Pro Asp  
 20 25 30

Ala Lys Asp Arg Ile Leu Ala Ser Val Arg Asp Tyr His Arg Glu Gln  
 35 40 45

Glu Ser Pro Thr Phe Val Ala Gly Ser Thr Pro Ile Arg Pro Ser Gly  
 50 55 60

Ala Val Leu Asp Glu Asp Arg Val Ala Leu Val Glu Ala Ala Leu  
 65 70 75 80

Glu Leu Arg Ile Ala Ala Gly Gly Asn Ala Arg Arg Phe Glu Ser Glu  
 85 90 95

Phe Ala Arg Phe Phe Gly Leu Arg Lys Ala His Leu Val Asn Ser Gly  
 100 105 110

Ser Ser Ala Asn Leu Leu Ala Leu Ser Ser Leu Thr Ser Pro Lys Leu  
 115 120 125

Gly Glu Ala Arg Leu Arg Pro Gly Asp Glu Val Ile Thr Ala Ala Val  
 130 135 140

Gly Phe Pro Thr Thr Ile Asn Pro Ala Val Gln Asn Gly Leu Val Pro  
 145 150 155 160

Val Phe Val Asp Val Glu Leu Gly Thr Tyr Asn Ala Thr Pro Asp Arg  
 165 170 175

Ile Lys Ala Ala Val Thr Glu Arg Thr Arg Ala Ile Met Leu Ala His  
 180 185 190

Thr Leu Gly Asn Pro Phe Ala Ala Asp Glu Ile Ala Glu Ile Ala Lys  
 195 200 205

Glu His Glu Leu Phe Leu Val Glu Asp Asn Cys Asp Ala Val Gly Ser  
 210 215 220

Thr Tyr Arg Gly Arg Leu Thr Gly Thr Phe Gly Asp Leu Thr Thr Val  
 225 230 235 240

Ser Phe Tyr Pro Ala His His Ile Thr Ser Gly Glu Gly Gly Cys Val  
 245 250 255

Leu Thr Gly Ser Leu Glu Leu Ala Arg Ile Ile Glu Ser Leu Arg Asp  
 260 265 270

Trp Gly Arg Asp Cys Trp Cys Glu Pro Gly Val Asp Asn Thr Cys Arg  
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275		280		285											
Lys	Arg	Phe	Asp	Tyr	His	Leu	Gly	Thr	Leu	Pro	Pro	Gly	Tyr	Asp	His
290						295					300				
Lys	Tyr	Thr	Phe	Ser	His	Val	Gly	Tyr	Asn	Leu	Lys	Thr	Thr	Asp	Leu
305					310					315					320
Gln	Ala	Ala	Leu	Ala	Leu	Ser	Gln	Leu	Ser	Lys	Ile	Ser	Ala	Phe	Gly
				325					330					335	
Ser	Ala	Arg	Arg	Arg	Asn	Trp	Arg	Arg	Leu	Arg	Glu	Gly	Leu	Ser	Gly
			340					345					350		
Leu	Pro	Gly	Leu	Leu	Leu	Pro	Val	Ala	Thr	Pro	His	Ser	Asp	Pro	Ser
		355					360					365			
Trp	Phe	Gly	Phe	Ala	Ile	Thr	Ile	Ser	Ala	Asp	Ala	Gly	Phe	Thr	Arg
	370					375					380				
Ala	Ala	Leu	Val	Asn	Phe	Leu	Glu	Ser	Arg	Asn	Ile	Gly	Thr	Arg	Leu
385				390						395					400
Leu	Phe	Gly	Gly	Asn	Ile	Thr	Arg	His	Pro	Ala	Phe	Glu	Gln	Val	Arg
				405					410					415	
Tyr	Arg	Ile	Ala	Asp	Ala	Leu	Thr	Asn	Ser	Asp	Ile	Val	Thr	Asp	Arg
			420					425					430		
Thr	Phe	Trp	Val	Gly	Val	Tyr	Pro	Gly	Ile	Thr	Asp	Gln	Met	Ile	Asp
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 <213> Saccharopolyspora spinosa

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 <223> ORF14; 4-aminotransferase

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Val Ile Asn Leu His Gln Pro Ile Leu Gly Thr Glu Glu Leu Asp Ala	
1 5 10 15	
atc gcg gag gtg ttc gcc tcc aac tgg atc ggg ctc ggg ccg cgc acc	96
Ile Ala Glu Val Phe Ala Ser Asn Trp Ile Gly Leu Gly Pro Arg Thr	
20 25 30	
cgg acg ttc gag gcc gaa ttc gcc cac cac ctg gga gtg gat ccc gaa	144
Arg Thr Phe Glu Ala Glu Phe Ala His His Leu Gly Val Asp Pro Glu	
35 40 45	
cag gtc gtg ttc ctc aac tcg ggg act gcc gcg ctg ttc ctt acc gtg	192
Gln Val Val Phe Leu Asn Ser Gly Thr Ala Ala Leu Phe Leu Thr Val	
50 55 60	

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cag Gln 65	gtg Val	ctc Leu	gac Asp	ctc Leu	ggc Gly 70	cca Pro	ggc Gly	gac Asp	gac Asp	gtg Val 75	gta Val	ctt Leu	cct Pro	tcg Ser	ata Ile 80	240
agc Ser	ttc Phe	gtg Val	gcg Ala	gcg Ala 85	gcc Ala	aac Asn	gcc Ala	atc Ile	gca Ala 90	tcc Ser	tcc Ser	ggt Gly	gcc Ala	cgc Arg 95	ccg Pro	288
gtg Val	ttc Phe	tgc Cys	gac Asp 100	gtc Val	gac Asp	ccc Pro	cgg Arg	acg Thr 105	ttg Leu	aac Asn	ccc Pro	acg Thr	ctg Leu 110	gat Asp	gat Asp	336
gtg Val	gcg Ala	agg Arg 115	gcc Ala	atc Ile	acg Thr	ccg Pro	gcg Ala 120	acc Thr	aag Lys	gcc Ala	gta Val	ttg Leu 125	ctg Leu	ctc Leu	cac His	384
tat Tyr	gga Gly 130	gga Gly	tcg Ser	ccg Pro	gga Gly 135	gaa Glu	gtc Val	acc Thr	gcg Ala	atc Ile	gcc Ala 140	gat Asp	ttc Phe	tgc Cys	cgt Arg	432
gaa Glu 145	aag Lys	ggc Gly	ctc Leu	atg Met	ctc Leu 150	atc Ile	gag Glu	gac Asp	tcc Ser	gcc Ala 155	tgc Cys	gcg Ala	gtg Val	gca Ala	tcg Ser 160	480
tcc Ser	gtg Val	cac His	ggc Gly 165	acc Thr	gct Ala	tgc Cys	gga Gly	acc Thr	ttt Phe 170	ggt Gly	gac Asp	ctg Leu	gcc Ala	acg Thr 175	tgg Trp	528
agt Ser	ttc Phe	gat Asp	gcg Ala 180	atg Met	aag Lys	atc Ile	ctg Leu	gtc Val 185	acc Thr	ggg Gly	gat Asp	ggg Gly	ggc Gly 190	atg Met	ttc Phe	576
tac Tyr	gcg Ala	gcg Ala 195	gat Asp	ccg Pro	gag Glu	ctg Leu	gcg Ala 200	cac His	cgc Arg	gca Ala	aga Arg	cga Arg 205	ctc Leu	gcc Ala	tac Tyr	624
cac His	ggt Gly 210	ctt Leu	gag Glu	cag Gln	atg Met	agc Ser 215	gga Gly	ttc Phe	gat Asp	tcg Ser	gcc Ala 220	aag Lys	tct Ser	tcc Ser	aac Asn	672
cgc Arg 225	tgg Trp	tgg Trp	gat Asp	att Ile	cgc Arg 230	gtc Val	gaa Glu	gac Asp	atc Ile	ggc Gly 235	cag Gln	cgg Arg	ctg Leu	atc Ile	ggg Gly 240	720
aac Asn	gac Asp	atg Met	acg Thr	gca Ala 245	gcg Ala	ctt Leu	ggc Gly	agc Ser	gtg Val 250	cag Gln	ctg Leu	cgc Arg	aaa Lys	ctg Leu 255	cca Pro	768
gaa Glu	ttc Phe	atc Ile	aac Asn 260	agg Arg	cgt Arg	aga Arg	gaa Glu	atc Ile 265	gct Ala	acg Thr	cag Gln	tac Tyr	gac Asp 270	cgg Arg	ttg Leu	816
ctt Leu	tcc Ser	gat Asp 275	gtg Val	ccg Pro	ggt Gly	gtc Val	ctc Leu 280	cta Leu	ccg Pro	ccg Pro	acg Thr	cta Leu 285	ccg Pro	gat Asp	ggg Gly	864
cac His	gtc Val 290	tcg Ser	tca Ser	cac His	tac Tyr	ttc Phe 295	tac Tyr	tgg Trp	gtc Val	cag Gln	ctg Leu 300	gct Ala	ccg Pro	gag Glu	atc Ile	912
cgc Arg	gac Asp	cag Gln	gtg Val	gcg Ala	cag Gln	caa Gln	atg Met	ctg Leu	gaa Glu	cgc Arg	ggc Gly	atc Ile	tac Tyr	acg Thr	agc Ser	960

305	LeA33955-US										315	320					
tac cgc tac ccg ccc ctg cac aag gtc ccc atc tac cgc gcg gac tgc	1008																
Tyr Arg Tyr Pro Pro Leu His Lys Val Pro Ile Tyr Arg Ala Asp Cys																	
	325 330 335																
aag ctg cct tct gcg gag cac gcc tgc cgc aga aca ctc ctg cta cca	1056																
Lys Leu Pro Ser Ala Glu His Ala Cys Arg Arg Thr Leu Leu Pro																	
	340 345 350																
ctg cac cca agc ctt gac gac gcc gag gtg cgc acg gtg gct gac gag	1104																
Leu His Pro Ser Leu Asp Asp Ala Glu Val Arg Thr Val Ala Asp Glu																	
	355 360 365																
ttc cag aag gcc gtc gaa cac cac atc agc caa aga tca cca ctc cga	1152																
Phe Gln Lys Ala Val Glu His His Ile Ser Gln Arg Ser Pro Leu Arg																	
	370 375 380																
aag tga	1158																
Lys																	
385																	

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 <212> PRT  
 <213> Saccharopolyspora spinosa

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 Arg Thr Phe Glu Ala Glu Phe Ala His His Leu Gly Val Asp Pro Glu  
 35 40 45  
 Gln Val Val Phe Leu Asn Ser Gly Thr Ala Ala Leu Phe Leu Thr Val  
 50 55 60  
 Gln Val Leu Asp Leu Gly Pro Gly Asp Asp Val Val Leu Pro Ser Ile  
 65 70 75 80  
 Ser Phe Val Ala Ala Ala Asn Ala Ile Ala Ser Ser Gly Ala Arg Pro  
 85 90 95  
 Val Phe Cys Asp Val Asp Pro Arg Thr Leu Asn Pro Thr Leu Asp Asp  
 100 105 110  
 Val Ala Arg Ala Ile Thr Pro Ala Thr Lys Ala Val Leu Leu Leu His  
 115 120 125  
 Tyr Gly Gly Ser Pro Gly Glu Val Thr Ala Ile Ala Asp Phe Cys Arg  
 130 135 140  
 Glu Lys Gly Leu Met Leu Ile Glu Asp Ser Ala Cys Ala Val Ala Ser  
 145 150 155 160  
 Ser Val His Gly Thr Ala Cys Gly Thr Phe Gly Asp Leu Ala Thr Trp  
 165 170 175  
 Ser Phe Asp Ala Met Lys Ile Leu Val Thr Gly Asp Gly Gly Met Phe

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180 185 190

Tyr Ala Ala Asp Pro Glu Leu Ala His Arg Ala Arg Arg Leu Ala Tyr  
195 200 205

His Gly Leu Glu Gln Met Ser Gly Phe Asp Ser Ala Lys Ser Ser Asn  
210 215 220

Arg Trp Trp Asp Ile Arg Val Glu Asp Ile Gly Gln Arg Leu Ile Gly  
225 230 235 240

Asn Asp Met Thr Ala Ala Leu Gly Ser Val Gln Leu Arg Lys Leu Pro  
245 250 255

Glu Phe Ile Asn Arg Arg Arg Glu Ile Ala Thr Gln Tyr Asp Arg Leu  
260 265 270

Leu Ser Asp Val Pro Gly Val Leu Leu Pro Pro Thr Leu Pro Asp Gly  
275 280 285

His Val Ser Ser His Tyr Phe Tyr Trp Val Gln Leu Ala Pro Glu Ile  
290 295 300

Arg Asp Gln Val Ala Gln Gln Met Leu Glu Arg Gly Ile Tyr Thr Ser  
305 310 315 320

Tyr Arg Tyr Pro Pro Leu His Lys Val Pro Ile Tyr Arg Ala Asp Cys  
325 330 335

Lys Leu Pro Ser Ala Glu His Ala Cys Arg Arg Thr Leu Leu Leu Pro  
340 345 350

Leu His Pro Ser Leu Asp Asp Ala Glu Val Arg Thr Val Ala Asp Glu  
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Phe Gln Lys Ala Val Glu His His Ile Ser Gln Arg Ser Pro Leu Arg  
370 375 380

Lys  
385

<210> 35  
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<213> Saccharopolyspora spinosa

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<222> (1)..(747)  
<223> ORF15; N-dimethyltransferase

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cca gat cat gcc gac atc tac gac gcg atc cac tcc gcg cgt ggc cgg 96  
Pro Asp His Ala Asp Ile Tyr Asp Ala Ile His Ser Ala Arg Gly Arg  
20 25 30

gac tgg gca gcc gag gcc ggg gaa gta gtc cag ctc gta cgc acc agg 144  
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Asp	Trp	Ala	Ala	Glu	Ala	Gly	Glu	Val	Val	Gln	Leu	Val	Arg	Thr	Arg	
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ctg	ccc	gaa	gca	cag	tcc	cta	ctc	gac	gtc	gcc	tgt	ggg	acc	ggg	gcg	192
Leu	Pro	Glu	Ala	Gln	Ser	Leu	Leu	Asp	Val	Ala	Cys	Gly	Thr	Gly	Ala	
	50					55					60					
cac	cta	gag	cga	ttc	cgt	gcc	gaa	tac	gcg	aag	gtc	gcg	ggg	ctt	gaa	240
His	Leu	Glu	Arg	Phe	Arg	Ala	Glu	Tyr	Ala	Lys	Val	Ala	Gly	Leu	Glu	
	65				70					75					80	
ctg	tcc	gat	gcg	atg	cgg	gag	atc	gcg	atc	aga	cga	gtc	cct	gag	gta	288
Leu	Ser	Asp	Ala	Met	Arg	Glu	Ile	Ala	Ile	Arg	Arg	Val	Pro	Glu	Val	
				85				90						95		
ccg	att	cac	atc	ggg	gac	atc	cgc	gat	ttc	gac	ctc	ggc	gag	cca	ttc	336
Pro	Ile	His	Ile	Gly	Asp	Ile	Arg	Asp	Phe	Asp	Leu	Gly	Glu	Pro	Phe	
			100					105					110			
gac	gtc	atc	acc	tgc	ctg	tgc	ttt	acc	gcg	gct	tac	atg	cgg	acc	gtt	384
Asp	Val	Ile	Thr	Cys	Leu	Cys	Phe	Thr	Ala	Ala	Tyr	Met	Arg	Thr	Val	
		115					120					125				
gac	gac	ctg	cga	cgc	gtg	acg	cgg	aac	atg	gcc	cgg	cac	ctg	gcc	cct	432
Asp	Asp	Leu	Arg	Arg	Val	Thr	Arg	Asn	Met	Ala	Arg	His	Leu	Ala	Pro	
	130					135					140					
ggg	gga	gtc	gcg	gtc	atc	gaa	ccc	tgg	tgg	ttt	ccc	gac	aag	ttc	atc	480
Gly	Gly	Val	Ala	Val	Ile	Glu	Pro	Trp	Trp	Phe	Pro	Asp	Lys	Phe	Ile	
	145				150					155					160	
gac	ggg	ttc	gtc	acc	gga	gcc	gtc	gcg	cac	cac	ggc	gag	cgg	gtg	atc	528
Asp	Gly	Phe	Val	Thr	Gly	Ala	Val	Ala	His	His	Gly	Glu	Arg	Val	Ile	
				165					170					175		
agc	cgg	cta	tcg	cac	tcg	gtc	ctg	gag	ggc	cgt	acg	agc	cgg	atg	acc	576
Ser	Arg	Leu	Ser	His	Ser	Val	Leu	Glu	Gly	Arg	Thr	Ser	Arg	Met	Thr	
			180					185					190			
gtc	cgc	tac	aca	gtc	gcc	gaa	ccc	acc	ggg	atc	cgg	gac	ttc	aca	gag	624
Val	Arg	Tyr	Thr	Val	Ala	Glu	Pro	Thr	Gly	Ile	Arg	Asp	Phe	Thr	Glu	
		195					200					205				
ttc	gaa	atc	ctc	tcg	ctg	ttc	act	gag	gac	gag	tac	acc	gcc	gcg	ctc	672
Phe	Glu	Ile	Leu	Ser	Leu	Phe	Thr	Glu	Asp	Glu	Tyr	Thr	Ala	Ala	Leu	
	210					215					220					
gaa	gac	gca	ggg	atc	cgc	gcg	gaa	tac	ctt	cct	gga	gca	ccg	aac	ggc	720
Glu	Asp	Ala	Gly	Ile	Arg	Ala	Glu	Tyr	Leu	Pro	Gly	Ala	Pro	Asn	Gly	
	225				230					235					240	
cga	ggc	ctg	ttc	gtc	gga	atc	cgc	aac	tga							750
Arg	Gly	Leu	Phe	Val	Gly	Ile	Arg	Asn								
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<210> 36  
 <211> 249  
 <212> PRT  
 <213> Saccharopolyspora spinosa

<400> 36  
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atc ggg gca cgg gac cac cag cgc ggg gag gat gcc gtg gcg aaa ttg Ile Gly Ala Arg Asp His Gln Arg Gly Glu Asp Ala Val Ala Lys Leu	144
cgt gcg gac ggc gtc gat gcg ttc gcg gta tcc ctg gac gtg aca gac Arg Ala Asp Gly Val Asp Ala Phe Ala Val Ser Leu Asp Val Thr Asp	192
gac gcg agc gtc gcg gct gct gcg gct ctg ctc gag gag cgc gcc ggc Asp Ala Ser Val Ala Ala Ala Ala Leu Leu Glu Glu Arg Ala Gly	240
cgg ctc gat gtg ctg gtt aat aac gcc ggc atc gcc ggg gca tgg ccg Arg Leu Asp Val Leu Val Asn Asn Ala Gly Ile Ala Gly Ala Trp Pro	288
gag gag ccc tcg acc gtc aca ccg gcg agc ctc ccg gcg gtg gtg gag Glu Glu Pro Ser Thr Val Thr Pro Ala Ser Leu Arg Ala Val Val Glu	336
acc aac gtg atc ggc gtc gtt ccg gtt acc aac gct atg ctg ccg ttg Thr Asn Val Ile Gly Val Val Arg Val Thr Asn Ala Met Leu Pro Leu	384
cta cgc cgc tcc gag cgc ccg ccg atc gtc aac cag tcc agc cac gtc Leu Arg Arg Ser Glu Arg Pro Arg Ile Val Asn Gln Ser Ser His Val	432
gct tcc ctg acc ttg caa acc acg ccg ggc gtc gac ctc ggc ggg atc Ala Ser Leu Thr Leu Gln Thr Thr Pro Gly Val Asp Leu Gly Gly Ile	480
agc gga gcc tac tca ccg tcg aag acg ttc ctc aac gcg atc acc atc Ser Gly Ala Tyr Ser Pro Ser Lys Thr Phe Leu Asn Ala Ile Thr Ile	528
cag tac gcc aag gaa ctc agc gat acc aac atc aaa atc aac aac gcc Gln Tyr Ala Lys Glu Leu Ser Asp Thr Asn Ile Lys Ile Asn Asn Ala	576
tgc ccc ggc tac gtc gcg acc gac ctt aac ggc ttc cac gga acc agc Cys Pro Gly Tyr Val Ala Thr Asp Leu Asn Gly Phe His Gly Thr Ser	624
acg ccg gca gac ggt gcc agg atc gcc att ccg ctc gcc acg ctg cca Thr Pro Ala Asp Gly Ala Arg Ile Ala Ile Arg Leu Ala Thr Leu Pro	672
gac gac ggc ccg acc gga ggc atg ttc gac gac gcc ggg aat gtg ccc Asp Asp Gly Pro Thr Gly Gly Met Phe Asp Asp Ala Gly Asn Val Pro	720
tgg tga Trp	726

<210> 38  
<211> 241

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 38

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 Gly Tyr Glu Ile Ala Ala Gly Leu Gly Ala Leu Gly Trp Ser Val Gly  
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 Ile Gly Ala Arg Asp His Gln Arg Gly Glu Asp Ala Val Ala Lys Leu  
 35 40 45  
 Arg Ala Asp Gly Val Asp Ala Phe Ala Val Ser Leu Asp Val Thr Asp  
 50 55 60  
 Asp Ala Ser Val Ala Ala Ala Ala Ala Leu Leu Glu Glu Arg Ala Gly  
 65 70 75 80  
 Arg Leu Asp Val Leu Val Asn Asn Ala Gly Ile Ala Gly Ala Trp Pro  
 85 90 95  
 Glu Glu Pro Ser Thr Val Thr Pro Ala Ser Leu Arg Ala Val Val Glu  
 100 105 110  
 Thr Asn Val Ile Gly Val Val Arg Val Thr Asn Ala Met Leu Pro Leu  
 115 120 125  
 Leu Arg Arg Ser Glu Arg Pro Arg Ile Val Asn Gln Ser Ser His Val  
 130 135 140  
 Ala Ser Leu Thr Leu Gln Thr Thr Pro Gly Val Asp Leu Gly Gly Ile  
 145 150 155 160  
 Ser Gly Ala Tyr Ser Pro Ser Lys Thr Phe Leu Asn Ala Ile Thr Ile  
 165 170 175  
 Gln Tyr Ala Lys Glu Leu Ser Asp Thr Asn Ile Lys Ile Asn Asn Ala  
 180 185 190  
 Cys Pro Gly Tyr Val Ala Thr Asp Leu Asn Gly Phe His Gly Thr Ser  
 195 200 205  
 Thr Pro Ala Asp Gly Ala Arg Ile Ala Ile Arg Leu Ala Thr Leu Pro  
 210 215 220  
 Asp Asp Gly Pro Thr Gly Gly Met Phe Asp Asp Ala Gly Asn Val Pro  
 225 230 235 240  
 Trp

&lt;210&gt; 39

&lt;211&gt; 837

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(834)

&lt;223&gt; ORF17; transcription regulator

## LeA33955-US

&lt;400&gt; 39

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cac	ttc	ggc	cgg	gcc	gcc	cag	cgc	ctg	ggc	atc	gcc	cag	ccg	ccg	ctg	96
His	Phe	Gly	Arg	Ala	Ala	Gln	Arg	Leu	Gly	Ile	Ala	Gln	Pro	Pro	Leu	
			20					25					30			
tcg	cgg	acg	atc	gcc	cag	ctc	gag	caa	cga	ctc	gga	gtc	gtg	ttg	ctg	144
Ser	Arg	Thr	Ile	Ala	Gln	Leu	Glu	Gln	Arg	Leu	Gly	Val	Val	Leu	Leu	
		35					40					45				
caa	cgc	acc	agc	cgc	aaa	gtc	tcg	ctc	acc	gaa	gcc	ggg	gca	atg	ctg	192
Gln	Arg	Thr	Ser	Arg	Lys	Val	Ser	Leu	Thr	Glu	Ala	Gly	Ala	Met	Leu	
		50				55					60					
ctg	acc	gaa	ggc	cgg	gcg	atc	ctc	ggc	gcg	ctg	gca	gca	gcc	gag	cga	240
Leu	Thr	Glu	Gly	Arg	Ala	Ile	Leu	Gly	Ala	Leu	Ala	Ala	Ala	Glu	Arg	
		65			70					75					80	
cgc	acc	cag	cgt	gcc	gcg	acg	agc	cag	ccc	tcg	cta	gtc	ctg	gct	gcc	288
Arg	Thr	Gln	Arg	Ala	Ala	Thr	Ser	Gln	Pro	Ser	Leu	Val	Leu	Ala	Ala	
				85					90					95		
aag	gcc	ggc	gcc	tcc	ggt	gag	ctg	ctg	gcg	aag	ttg	ctc	gac	gcg	tac	336
Lys	Ala	Gly	Ala	Ser	Gly	Glu	Leu	Leu	Ala	Lys	Leu	Leu	Asp	Ala	Tyr	
			100					105					110			
gcc	gcc	gag	ccg	gga	gcc	gtg	gcc	gtc	gac	ctg	ctg	ctc	tgc	gaa	tcc	384
Ala	Ala	Glu	Pro	Gly	Ala	Val	Ala	Val	Asp	Leu	Leu	Leu	Cys	Glu	Ser	
		115					120					125				
cag	ccc	cag	aaa	acg	ctg	cat	gac	ggc	cgg	gcc	gac	gtg	gcg	ctg	ttg	432
Gln	Pro	Gln	Lys	Thr	Leu	His	Asp	Gly	Arg	Ala	Asp	Val	Ala	Leu	Leu	
		130				135					140					
cat	caa	ccc	ttc	gac	ccg	acg	gcc	gaa	ctc	gac	atc	gaa	att	ctg	aac	480
His	Gln	Pro	Phe	Asp	Pro	Thr	Ala	Glu	Leu	Asp	Ile	Glu	Ile	Leu	Asn	
					150					155					160	
acc	gag	caa	caa	gtc	gcc	att	ctt	ccg	acc	tcg	cat	ccg	ctt	gcc	agc	528
Thr	Glu	Gln	Gln	Val	Ala	Ile	Leu	Pro	Thr	Ser	His	Pro	Leu	Ala	Ser	
				165					170					175		
gag	ccc	cat	gta	cgg	atg	gcg	gat	gtc	agc	tca	ctg	ccg	gat	ctc	ccg	576
Glu	Pro	His	Val	Arg	Met	Ala	Asp	Val	Ser	Ser	Leu	Pro	Asp	Leu	Pro	
			180					185					190			
ctt	gcg	cgc	tgg	ccc	ggc	ccc	gac	ggc	gtc	tat	cca	gat	ggc	ccc	ggc	624
Leu	Ala	Arg	Trp	Pro	Gly	Pro	Asp	Gly	Val	Tyr	Pro	Asp	Gly	Pro	Gly	
		195					200					205				
gtg	gaa	gta	cgc	aac	cag	acg	caa	ctg	ttc	caa	atg	atc	gca	ctc	ggc	672
Val	Glu	Val	Arg	Asn	Gln	Thr	Gln	Leu	Phe	Gln	Met	Ile	Ala	Leu	Gly	
		210				215					220					
cgc	act	acc	gtg	gtc	atg	ccc	gaa	tcc	agt	cgc	gtc	aac	ctg	ctc	gaa	720
Arg	Thr	Thr	Val	Val	Met	Pro	Glu	Ser	Ser	Arg	Val	Asn	Leu	Leu	Glu	
					230					235					240	
ggc	ctc	gcc	gcc	gta	ccg	gtt	cta	gac	gcg	ccg	gac	gtg	acg	aca	gtc	768

LeA33955-US																
Gly	Leu	Ala	Ala	Val	Pro	Val	Leu	Asp	Ala	Pro	Asp	Val	Thr	Thr	Val	
				245					250					255		
atc	gcc	tg	ccg	ccc	cac	agc	cgc	tcc	cga	gca	ctc	gcc	ggc	ttg	gtc	816
Ile	Ala	Trp	Pro	Pro	His	Ser	Arg	Ser	Arg	Ala	Leu	Ala	Gly	Leu	Val	
				260					265					270		
cgc	gtg	gcc	aca	ctc	ctc	taa										837
Arg	Val	Ala	Thr	Leu	Leu											
				275												

<210> 40  
<211> 278  
<212> PRT  
<213> Saccharopolyspora spinosa

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Gly Leu Ala Ala Val Pro Val Leu Asp Ala Pro Asp Val Thr Thr Val  
245 250 255

Ile Ala Trp Pro Pro His Ser Arg Ser Arg Ala Leu Ala Gly Leu Val  
260 265 270

Arg Val Ala Thr Leu Leu  
275

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Leu	Arg	Gly	Pro	Ser 165	Leu	Thr	Val	Asp	Ser 170	Gly	Gln	Ser	Ser	Ser 175	Leu
gtc Val	ggc Gly	gtg Val	cat His 180	ctc Leu	gcc Ala	agc Ser	gag Glu	agc Ser 185	ctg Leu	cga Arg	cgg Arg	ggt Gly	gag Glu 190	tgc Cys	acg Thr
atc Ile	gca Ala	ctc Leu 195	gcc Ala	ggc Gly	ggc Gly	gtg Val	aac Asn 200	ctc Leu	aac Asn	ctg Leu	gcc Ala	gcc Ala 205	gag Glu	agc Ser	aac Asn
agc Ser 210	gct Ala	ctg Leu	atg Met	gac Asp	ttc Phe	ggc Gly 215	gcg Ala	ctc Leu	tcc Ser	ccg Pro	gac Asp 220	ggt Gly	cgc Arg	tgc Cys	ttc Phe
acc Thr 225	ttc Phe	gat Asp	gtg Val	cgg Arg	gcg Ala 230	aac Asn	ggt Gly	tac Tyr	gtc Val	cgt Arg 235	ggt Gly	gag Glu	ggc Gly	ggc Gly	ggc Gly 240
ctt Leu	gtc Val	gtg Val	ctg Leu	aag Lys 245	aag Lys	gcc Ala	gat Asp	cag Gln	gcg Ala 250	cac His	gcc Ala	gat Asp	ggc Gly	gac Asp 255	cgg Arg
atc Ile	tac Tyr	tgc Cys	ctc Leu 260	atc Ile	cgc Arg	ggc Gly	agc Ser	gcg Ala 265	gtc Val	aac Asn	aac Asn	gat Asp	ggg Gly 270	ggc Gly	ggt Gly
gcc Ala	ggg Gly	ctc Leu 275	acc Thr	gtt Val	ccg Pro	gcg Ala	gcg Ala 280	gac Asp	gcc Ala	cag Gln	gcg Ala	gag Glu 285	ctg Leu	ctg Leu	cgc Arg
cag Gln 290	gca Ala	tac Tyr	cgg Arg	aac Asn	gcg Ala	ggc Gly 295	gtc Val	gac Asp	ccg Pro	gcc Ala	gcc Ala 300	gtg Val	cag Gln	tat Tyr	gtc Val
gag Glu 305	ctc Leu	cac His	ggc Gly	agc Ser	gcg Ala 310	acc Thr	agg Arg	gtc Val	ggg Gly	gat Asp 315	ccc Pro	gtc Val	gaa Glu	gca Ala	gca Ala 320
gcc Ala	ctc Leu	gga Gly	gct Ala	gtc Val 325	ctg Leu	ggg Gly	gcg Ala	gcg Ala	aga Arg 330	cgg Arg	ccc Pro	ggc Gly	gac Asp	gag Glu 335	ctg Leu
cgt Arg	gtg Val	ggg Gly	tcg Ser 340	gcg Ala	aag Lys	acc Thr	aac Asn	gtc Val 345	ggc Gly	cat His	ctg Leu	gaa Glu	gca Ala 350	gcg Ala	gcg Ala
ggc Gly	gtc Val	acc Thr 355	ggg Gly	ttg Leu	ctg Leu	aag Lys	acc Thr 360	gca Ala	ctc Leu	agc Ser	atc Ile	tgg Trp 365	cac His	cgc Arg	gaa Glu
ctg Leu	ccg Pro 370	ccg Pro	agt Ser	ctt Leu	cat His	ttc Phe 375	acc Thr	gcc Ala	ccc Pro	aac Asn	ccg Pro 380	gaa Glu	atc Ile	ccg Pro	ctg Leu
gac Asp 385	gaa Glu	ttg Leu	aac Asn	cta Leu	cgc Arg 390	gtc Val	cag Gln	cgt Arg	gat Asp	ctg Leu 395	cgg Arg	ccg Pro	tgg Trp	ccg Pro	gag Glu 400
agc Ser	gag Glu	ggg Gly	ccg Pro	ctg Leu 405	ctg Leu	gcc Ala	ggc Gly	gtc Val	agc Ser 410	gcc Ala	ttc Phe	gga Gly	atg Met	gga Gly 415	ggc Gly

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acg Thr	aac Asn	tgc Cys	cac His 420	ctg Leu	gtg Val	ctc Leu	tcc Ser	ggc Gly 425	acg Thr	tcc Ser	cgg Arg	gtg Val	gag Glu 430	cga Arg	cgg Arg	1296
cgc Arg	agt Ser	gga Gly 435	ccc Pro	gct Ala	gag Glu	gcg Ala	acc Thr 440	atg Met	ccg Pro	tgg Trp	gtc Val	ttg Leu 445	tcg Ser	gcc Ala	aga Arg	1344
aca Thr	ccg Pro 450	gtc Val	gca Ala	ttg Leu	cgt Arg	gcg Ala 455	cag Gln	gcg Ala	gcg Ala	cgc Arg	ttg Leu 460	cac His	acg Thr	cac His	ctc Leu	1392
aat Asn 465	acg Thr	gcc Ala	ggt Gly	caa Gln	agt Ser 470	ccg Pro	ttg Leu	gac Asp	gtc Val	gcc Ala 475	tac Tyr	tca Ser	ctg Leu	gcg Ala	acc Thr 480	1440
act Thr	cga Arg	tcc Ser	gcg Ala	ctg Leu 485	ccg Pro	cac His	cgg Arg	gcc Ala	gcg Ala 490	ctg Leu	gtc Val	gcg Ala	gac Asp	gac Asp 495	gaa Glu	1488
ccg Pro	aaa Lys	ctg Leu	ctc Leu 500	gcc Ala	ggg Gly	ttg Leu	aag Lys	gcc Ala 505	ctc Leu	gct Ala	gac Asp	ggc Gly	gac Asp 510	gac Asp	gcg Ala	1536
ccc Pro	acg Thr	ctg Leu 515	tgc Cys	cac His	ggc Gly	gcg Ala	act Thr 520	tcc Ser	ggc Gly	gag Glu	cgg Arg	gca Ala 525	gcg Ala	gtc Val	ttc Phe	1584
gtc Val	ttt Phe 530	ccc Pro	gga Gly	cag Gln	ggc Gly	agc Ser 535	cag Gln	tgg Trp	atc Ile	ggg Gly	atg Met 540	ggt Gly	agg Arg	cag Gln	ctg Leu	1632
ctc Leu 545	gaa Glu	acc Thr	tcc Ser	gag Glu	gtt Val 550	ttc Phe	gcg Ala	gcg Ala	tcg Ser	atg Met 555	tcg Ser	gac Asp	tgc Cys	gcc Ala	gac Asp 560	1680
gca Ala	ttg Leu	gcg Ala	ccg Pro	cac His 565	ctg Leu	gat Asp	tgg Trp	tcc Ser	ctg Leu 570	ctg Leu	gat Asp	gtg Val	ctg Leu	cgc Arg 575	aac Asn	1728
gcg Ala	gcc Ala	ggc Gly	gct Ala 580	gcg Ala	cac His	ctt Leu	gac Asp	cac His 585	gac Asp	gat Asp	gtc Val	gtc Val	cag Gln 590	ccc Pro	gcg Ala	1776
ctg Leu	ttc Phe	gcc Ala 595	atc Ile	atg Met	gtc Val	tcg Ser	ctc Leu 600	gcg Ala	gag Glu	ctc Leu	tgg Trp	cgt Arg 605	tcg Ser	tgg Trp	ggc Gly	1824
gtg Val	cgt Arg 610	ccg Pro	gtg Val	gcg Ala	gtc Val	gtc Val 615	ggg Gly	cac His	tcg Ser	cag Gln	ggg Gly 620	gag Glu	atc Ile	gcg Ala	gcg Ala	1872
gcc Ala 625	tgc Cys	gtc Val	gcc Ala	ggg Gly	gcc Ala 630	ctg Leu	tcc Ser	gtc Val	cgc Arg	gat Asp 635	gcc Ala	gcc Ala	agg Arg	gtg Val	gtg Val 640	1920
gcg Ala	gtg Val	cgc Arg	agc Ser	agg Arg 645	ctt Leu	ctg Leu	acg Thr	gcg Ala	ctg Leu 650	gcc Ala	ggc Gly	agt Ser	ggc Gly	gcg Ala 655	atg Met	1968
gcc Ala	tcg Ser	ttg Leu	cag Gln 660	cat His	ccc Pro	gcc Ala	gaa Glu	gag Glu 665	gtg Val	cgg Arg	caa Gln	atc Ile	ctg Leu 670	ttg Leu	ccc Pro	2016

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tgg	cgc	gat	cgg	atc	ggc	gtg	gcg	ggg	gtg	aac	gga	ccg	tcg	tcg	acc	2064
Trp	Arg	Asp	Arg	Ile	Gly	Val	Ala	Gly	Val	Asn	Gly	Pro	Ser	Ser	Thr	
		675					680					685				
ctg	gtg	tca	ggg	gac	cgg	gag	gcg	atg	gcg	gaa	ctg	ctg	gcc	gag	tgc	2112
Leu	Val	Ser	Gly	Asp	Arg	Glu	Ala	Met	Ala	Glu	Leu	Leu	Ala	Glu	Cys	
	690					695					700					
gca	gac	cga	gag	ctc	cgg	atg	cgc	cgg	att	ccc	gtt	gaa	tac	gcc	tcc	2160
Ala	Asp	Arg	Glu	Leu	Arg	Met	Arg	Arg	Ile	Pro	Val	Glu	Tyr	Ala	Ser	
705					710					715					720	
cat	tcg	cct	cac	atc	gag	gtt	gtc	cgg	gat	gag	ctg	ctg	ggg	ctg	ttg	2208
His	Ser	Pro	His	Ile	Glu	Val	Val	Arg	Asp	Glu	Leu	Leu	Gly	Leu	Leu	
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gcg	ccg	gtc	gaa	ccc	agg	acg	gga	agc	atc	ccg	atc	tat	tcg	acg	acg	2256
Ala	Pro	Val	Glu	Pro	Arg	Thr	Gly	Ser	Ile	Pro	Ile	Tyr	Ser	Thr	Thr	
			740					745					750			
acc	ggg	gac	ctg	ctg	gac	cgg	ccg	atg	gac	gcc	gac	tac	tgg	tac	cgc	2304
Thr	Gly	Asp	Leu	Leu	Asp	Arg	Pro	Met	Asp	Ala	Asp	Tyr	Trp	Tyr	Arg	
		755					760					765				
aac	ctt	cgt	caa	ccg	gtg	ctg	ttc	gaa	gcg	gcc	gtc	gag	gcc	ctg	ttg	2352
Asn	Leu	Arg	Gln	Pro	Val	Leu	Phe	Glu	Ala	Ala	Val	Glu	Ala	Leu	Leu	
	770					775					780					
aag	cgg	ggg	tac	gac	gca	ttc	atc	gag	atc	agc	cca	cac	ccg	gtg	ctg	2400
Lys	Arg	Gly	Tyr	Asp	Ala	Phe	Ile	Glu	Ile	Ser	Pro	His	Pro	Val	Leu	
785					790					795					800	
act	gcg	aac	atc	cag	gaa	acc	gcc	gtg	cga	gca	ggg	cgg	gag	gta	gtg	2448
Thr	Ala	Asn	Ile	Gln	Glu	Thr	Ala	Val	Arg	Ala	Gly	Arg	Glu	Val	Val	
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Ala	Leu	Gly	Thr	Leu	Arg	Arg	Gly	Glu	Gly	Gly	Met	Arg	Gln	Ala	Leu	
			820					825					830			
acg	tcg	ctg	gcc	aga	gca	cac	gta	cac	gga	gtg	gcc	gcg	gac	tgg	cac	2544
Thr	Ser	Leu	Ala	Arg	Ala	His	Val	His	Gly	Val	Ala	Ala	Asp	Trp	His	
		835					840					845				
gcg	gtc	ttc	gcc	ggt	acc	ggg	gcg	cag	cgg	gtc	gac	ctg	ccg	acg	tac	2592
Ala	Val	Phe	Ala	Gly	Thr	Gly	Ala	Gln	Arg	Val	Asp	Leu	Pro	Thr	Tyr	
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gcc	ttt	cag	cga	cag	cgc	tac	tgg	ctg	gac	gcg	aag	ctt	ccc	gac	gtc	2640
Ala	Phe	Gln	Arg	Gln	Arg	Tyr	Trp	Leu	Asp	Ala	Lys	Leu	Pro	Asp	Val	
865					870					875					880	
gcc	atg	ccc	gag	agc	gac	gtg	tcg	acg	gcg	ttg	cgg	gaa	aag	ctg	cgg	2688
Ala	Met	Pro	Glu	Ser	Asp	Val	Ser	Thr	Ala	Leu	Arg	Glu	Lys	Leu	Arg	
				885					890					895		
tct	tcg	ccg	agg	gcg	gac	gtg	gac	tcg	acg	acc	ctc	acg	atg	atc	cgg	2736
Ser	Ser	Pro	Arg	Ala	Asp	Val	Asp	Ser	Thr	Thr	Leu	Thr	Met	Ile	Arg	
			900					905					910			
gca	cag	gca	gcc	gtg	gtc	ctc	ggc	cac	tcc	gat	ccg	aaa	gag	gtg	gac	2784
Ala	Gln	Ala	Ala	Val	Val	Leu	Gly	His	Ser	Asp	Pro	Lys	Glu	Val	Asp	



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915	920	925	
ccg gat cgg acg ttc aag gac ctg ggc ttc gat tcc tcg atg gtg gtc Pro Asp Arg Thr Phe Lys Asp Leu Gly Phe Asp Ser Ser Met Val Val	930	935	940
gag ctg tgc gac cgc cta aac gcc gcc aca ggt ctg cga ctc gca ccg Glu Leu Cys Asp Arg Leu Asn Ala Ala Thr Gly Leu Arg Leu Ala Pro	945	950	955
agc gtc gtt ttc gac tgt cct acg ccg gac aag ctc gcc cgc cag gta Ser Val Val Phe Asp Cys Pro Thr Pro Asp Lys Leu Ala Arg Gln Val	965	970	975
cgg acg ttg ttg ttg ggc gag ccg gct ccc atg acg tca cac cgg ccg Arg Thr Leu Leu Leu Gly Glu Pro Ala Pro Met Thr Ser His Arg Pro	980	985	990
gac tcc gat gcg gac gag cct atc gcc gtg atc ggg atg ggc tgt cgg Asp Ser Asp Ala Asp Glu Pro Ile Ala Val Ile Gly Met Gly Cys Arg	995	1000	1005
ttt ccg ggt ggg gtg tcc tcg ccc gag gag ttg tgg cag ttg gtc gcc Phe Pro Gly Gly Val Ser Ser Pro Glu Glu Leu Trp Gln Leu Val Ala	1010	1015	1020
gct ggg cgg gac gtc gtg tcc gag ttc ccg gct gac cga ggt tgg gac Ala Gly Arg Asp Val Val Ser Glu Phe Pro Ala Asp Arg Gly Trp Asp	1025	1030	1035
ctg gag cgt gcg ggg aca tcg cac gtg cgc gcc ggc ggg ttc ttg cat Leu Glu Arg Ala Gly Thr Ser His Val Arg Ala Gly Gly Phe Leu His	1045	1050	1055
ggc gcc ccg gat ttt gac ccc ggg ttc ttc ccg att tcg ccg cgc gag Gly Ala Pro Asp Phe Asp Pro Gly Phe Phe Arg Ile Ser Pro Arg Glu	1060	1065	1070
gcg ttg gcg atg gat cca cag cag ccg ttg ctg ctg gaa atc gcc tgg Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu Glu Ile Ala Trp	1075	1080	1085
gaa gca gtc gaa cga ggc ggg atc aac ccg cag cac ctg cac gga agt Glu Ala Val Glu Arg Gly Gly Ile Asn Pro Gln His Leu His Gly Ser	1090	1095	1100
caa acc ggg gtc ttc gtc ggc gcg acc tcc ctg gac tac ggg cca cgc Gln Thr Gly Val Phe Val Gly Ala Thr Ser Leu Asp Tyr Gly Pro Arg	1105	1110	1115
ctg cac gaa gcg tcc gag gag gcg gcc ggg tac gtg ctc acc ggc agc Leu His Glu Ala Ser Glu Glu Ala Ala Gly Tyr Val Leu Thr Gly Ser	1125	1130	1135
acc acg agt gtg gcg tcg ggt ccg gtt gcg tat tcg ttc ggg ttc gag Thr Thr Ser Val Ala Ser Gly Arg Val Ala Tyr Ser Phe Gly Phe Glu	1140	1145	1150
ggc cct gcg gtg acg gtg gat acg gcg tgt tcg tcg tcg ttg gtg gcc Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala	1155	1160	1165
ctg cat ttg gcg tgt cag tcg ttg cgt tcg ggt gag tgt gat ctg gcg			

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Leu His Leu Ala Cys Gln Ser Leu Arg Ser Gly Glu Cys Asp Leu Ala	
1170 1175 1180	
ttg gcc ggt ggt gtg acc gtg atg gcc acg ccg ggg atg ttc gtg gag	3600
Leu Ala Gly Gly Val Thr Val Met Ala Thr Pro Gly Met Phe Val Glu	
1185 1190 1195 1200	
ttt tcg cgg cag cgt ggt ttg gcg ccg gat ggg cgg tgc aag tcg ttc	3648
Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg Cys Lys Ser Phe	
1205 1210 1215	
gcg gag gcc gcc gac ggc acc ggc tgg tcc gag ggt gct ggc ctg gtt	3696
Ala Glu Ala Ala Asp Gly Thr Gly Trp Ser Glu Gly Ala Gly Leu Val	
1220 1225 1230	
cta ctg gag cgg ttg tcg gat gcc ccg ccg aat ggg cat gag gtg ctg	3744
Leu Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly His Glu Val Leu	
1235 1240 1245	
gcg gtt gtt cgt ggt agt gcg gtg aat cag gac ggt gcg tcg aat ggt	3792
Ala Val Val Arg Gly Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly	
1250 1255 1260	
ttg acc gcg ccg aat ggt tcg tcg cag cag ccg gtg att gcc cag gca	3840
Leu Thr Ala Pro Asn Gly Ser Ser Gln Gln Arg Val Ile Ala Gln Ala	
1265 1270 1275 1280	
ttg gcg agt gcg ggg ttg tcg gtg tcc gat gtg gat gct gtg gag gcg	3888
Leu Ala Ser Ala Gly Leu Ser Val Ser Asp Val Asp Ala Val Glu Ala	
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His Gly Thr Gly Thr Arg Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu	
1300 1305 1310	
atc gcc acc tac ggc cag ggc ccg ctt ccg gaa ccg cca ttg tgg ttg	3984
Ile Ala Thr Tyr Gly Gln Gly Arg Leu Pro Glu Arg Pro Leu Trp Leu	
1315 1320 1325	
ggc tcg atg aag tcg aac atc ggt cac gcg cag gca gct gcg ggg ata	4032
Gly Ser Met Lys Ser Asn Ile Gly His Ala Gln Ala Ala Ala Gly Ile	
1330 1335 1340	
gcc gcc gtc atg aag atg gtg atg gcg atg ccg cac ggg cag cta ccg	4080
Ala Gly Val Met Lys Met Val Met Ala Met Arg His Gly Gln Leu Pro	
1345 1350 1355 1360	
cgc acg ttg cac gtg gat gag ccg act tct ggg gtg gat tgg tcg gcg	4128
Arg Thr Leu His Val Asp Glu Pro Thr Ser Gly Val Asp Trp Ser Ala	
1365 1370 1375	
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Gly Thr Val Gln Leu Leu Thr Glu Asn Thr Pro Trp Pro Gly Ser Gly	
1380 1385 1390	
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Arg Val Arg Arg Val Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn	
1395 1400 1405	
gcg cac gtc atc ctc gaa cag ccc ccg gga gtg ccg agt cag tct gcg	4272
Ala His Val Ile Leu Glu Gln Pro Pro Gly Val Pro Ser Gln Ser Ala	
1410 1415 1420	

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atg acc tat ctg gac gag cga cct gat gtc tcc tcg ctg gat gtt ggg Met Thr Tyr Leu Asp Glu Arg Pro Asp Val Ser Ser Leu Asp Val Gly 1460 1465 1470	4416
tac tcg ctg gcg ttg aca cgg tcg gcg ctg gat gag cga gcg gtg gtg Tyr Ser Leu Ala Leu Thr Arg Ser Ala Leu Asp Glu Arg Ala Val Val 1475 1480 1485	4464
ctg ggg tcg gac cgt gaa acg ttg ttg tgc ggt gtg aaa gcg ctg tct Leu Gly Ser Asp Arg Glu Thr Leu Leu Cys Gly Val Lys Ala Leu Ser 1490 1495 1500	4512
gcc ggt cat gag gct tct ggg ttg gtg acc gga tct gtg ggg gct ggg Ala Gly His Glu Ala Ser Gly Leu Val Thr Gly Ser Val Gly Ala Gly 1505 1510 1515 1520	4560
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gac gaa gct tgt gcc gag ctg gat gcg cat ctg ggc cag gaa atc ggg Asp Glu Ala Cys Ala Glu Leu Asp Ala His Leu Gly Gln Glu Ile Gly 1555 1560 1565	4704
gtt cgg gag gtg gtg tcc ggt tcg gat gcg cag ttg ctg gat cgg acg Val Arg Glu Val Val Ser Gly Ser Asp Ala Gln Leu Leu Asp Arg Thr 1570 1575 1580	4752
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ccg tct ggc ggt ggg atg ctg gcg gtg cct gct ggt gag gag ctg ttg Pro Ser Gly Gly Gly Met Leu Ala Val Pro Ala Gly Glu Glu Leu Leu 1650 1655 1660	4992
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Asn Ala Ala Gly Ser Val Val Leu Ser Gly Asp Arg Asp Val Leu Asp	
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gac ctt gcc ggt cgg ctg gac ggg caa ggg atc cgg tcg agg tgg ttg	5136
Asp Leu Ala Gly Arg Leu Asp Gly Gln Gly Ile Arg Ser Arg Trp Leu	
1700 1705 1710	
cgg gtg tcg cat gcg ttt cat tcg tat cgg atg gat ccg atg ctg gcg	5184
Arg Val Ser His Ala Phe His Ser Tyr Arg Met Asp Pro Met Leu Ala	
1715 1720 1725	
gag ttc gcc gaa ttg gca cga acc gtg gat tac cgg cgt tgt gaa gtg	5232
Glu Phe Ala Glu Leu Ala Arg Thr Val Asp Tyr Arg Arg Cys Glu Val	
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Pro Ile Val Ser Thr Leu Thr Gly Asp Leu Asp Ala Gly Arg Met	
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Ser Gly Pro Asp Tyr Trp Val Arg Gln Val Arg Glu Pro Val Arg Phe	
1765 1770 1775	
gcc gac ggt gtc cag gcg ctg gtc gag cac gat gtg gcc acc gtt gtc	5376
Ala Asp Gly Val Gln Ala Leu Val Glu His Asp Val Ala Thr Val Val	
1780 1785 1790	
gag ctc ggt ccg gac ggg gcg ttg tcg gcg ctg atc cag gaa tgt gtc	5424
Glu Leu Gly Pro Asp Gly Ala Leu Ser Ala Leu Ile Gln Glu Cys Val	
1795 1800 1805	
gcc gca tcc gat cac gcc ggg cgg ctg agc gcg gtc ccg gcg atg cgc	5472
Ala Ala Ser Asp His Ala Gly Arg Leu Ser Ala Val Pro Ala Met Arg	
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Arg Asn Gln Asp Glu Ala Gln Lys Val Met Thr Ala Leu Ala His Val	
1825 1830 1835 1840	
cac gta cgt ggt ggt gcg gtg gac tgg cgg tcg ttc ttc gcc ggt aca	5568
His Val Arg Gly Gly Ala Val Asp Trp Arg Ser Phe Phe Ala Gly Thr	
1845 1850 1855	
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1860 1865 1870	
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Tyr Trp Leu Asn Ala Leu Arg Glu Ser Ser Ala Gly Asp Met Gly Arg	
1875 1880 1885	
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Arg Val Glu Ala Lys Phe Trp Gly Ala Val Glu His Glu Asp Val Glu	
1890 1895 1900	
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Ser Leu Ala Arg Val Leu Gly Ile Val Asp Asp Gly Ala Ala Val Asp	
1905 1910 1915 1920	
tcc ctg aga agc gcc ctt ccg gtg ttg gcc ggt tgg cag cga acc cgc	5808
Ser Leu Arg Ser Ala Leu Pro Val Leu Ala Gly Trp Gln Arg Thr Arg	

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1925					1930					1935							
acc	acc	gag	tcc	att	atg	gat	cag	cgg	tgt	tac	cga	att	ggc	tgg	cgg		5856
Thr	Thr	Glu	Ser	Ile	Met	Asp	Gln	Arg	Cys	Tyr	Arg	Ile	Gly	Trp	Arg		
		1940					1945					1950					
cag	gta	gcc	gga	ctc	ccg	ccg	atg	gga	act	gtt	ttc	ggt	acc	tgg	ctg		5904
Gln	Val	Ala	Gly	Leu	Pro	Pro	Met	Gly	Thr	Val	Phe	Gly	Thr	Trp	Leu		
	1955						1960					1965					
gtc	ttc	gcg	cct	cat	ggc	tgg	tcc	agc	gaa	ccg	gag	gtg	gtg	gac	tgc		5952
Val	Phe	Ala	Pro	His	Gly	Trp	Ser	Ser	Glu	Pro	Glu	Val	Val	Asp	Cys		
	1970					1975					1980						
gtt	acg	gca	ctg	cgg	gca	cgt	ggt	gcc	tcg	gtg	gtg	ttg	gtg	gaa	gct		6000
Val	Thr	Ala	Leu	Arg	Ala	Arg	Gly	Ala	Ser	Val	Val	Leu	Val	Glu	Ala		
	1985				1990					1995					2000		
gat	ccc	gac	ccg	acc	tcc	ttc	ggc	gac	cgg	gta	cga	acc	ctg	tgt	tcg		6048
Asp	Pro	Asp	Pro	Thr	Ser	Phe	Gly	Asp	Arg	Val	Arg	Thr	Leu	Cys	Ser		
				2005					2010					2015			
ggc	ctt	ccg	gat	ctt	gtt	ggc	gtg	ttg	tca	atg	ttg	tgc	ttg	gaa	gaa		6096
Gly	Leu	Pro	Asp	Leu	Val	Gly	Val	Leu	Ser	Met	Leu	Cys	Leu	Glu	Glu		
			2020					2025					2030				
tcg	gtc	ctt	ccg	gga	ttt	tct	gcg	gtg	tca	cgg	ggt	ttt	gcg	ttg	acc		6144
Ser	Val	Leu	Pro	Gly	Phe	Ser	Ala	Val	Ser	Arg	Gly	Phe	Ala	Leu	Thr		
		2035					2040					2045					
gtg	gag	ttg	gtg	cgg	gtt	ttg	cgg	gca	gct	ggt	gcg	act	gcc	cgg	ttg		6192
Val	Glu	Leu	Val	Arg	Val	Leu	Arg	Ala	Ala	Gly	Ala	Thr	Ala	Arg	Leu		
	2050					2055					2060						
tgg	ttg	ctg	acg	tgt	ggt	ggc	gtg	tcg	gtg	gga	gat	gta	ccg	gtt	cgt		6240
Trp	Leu	Leu	Thr	Cys	Gly	Gly	Val	Ser	Val	Gly	Asp	Val	Pro	Val	Arg		
	2065				2070					2075					2080		
cca	gcg	cag	gcc	ctg	gcg	tgg	ggg	ttg	ggg	cgt	gtt	gtg	ggg	ttg	gag		6288
Pro	Ala	Gln	Ala	Leu	Ala	Trp	Gly	Leu	Gly	Arg	Val	Val	Gly	Leu	Glu		
			2085						2090					2095			
cat	ccg	gac	tgg	tgg	ggc	ggc	ttg	atc	gat	att	ccg	gtc	ttg	ttc	gac		6336
His	Pro	Asp	Trp	Trp	Gly	Gly	Leu	Ile	Asp	Ile	Pro	Val	Leu	Phe	Asp		
			2100					2105					2110				
gaa	gac	gct	caa	gag	cgg	ttg	tcg	att	gtg	ctg	gca	ggt	ctc	gat	gag		6384
Glu	Asp	Ala	Gln	Glu	Arg	Leu	Ser	Ile	Val	Leu	Ala	Gly	Leu	Asp	Glu		
		2115					2120					2125					
gac	gag	gtc	gcg	atc	cgt	cct	gac	ggc	atg	ttc	gcg	cgt	cgg	ttg	gta		6432
Asp	Glu	Val	Ala	Ile	Arg	Pro	Asp	Gly	Met	Phe	Ala	Arg	Arg	Leu	Val		
	2130					2135					2140						
cgc	cac	act	gtc	tca	gct	gat	gtg	aag	aag	gcg	tgg	cgc	ccc	agg	gga		6480
Arg	His	Thr	Val	Ser	Ala	Asp	Val	Lys	Lys	Ala	Trp	Arg	Pro	Arg	Gly		
	2145				2150					2155					2160		
tcg	gtg	ctg	gtg	acg	ggc	ggc	acg	ggt	ggt	ttg	ggg	gcg	cac	gtt	gct		6528
Ser	Val	Leu	Val	Thr	Gly	Gly	Thr	Gly	Gly	Leu	Gly	Ala	His	Val	Ala		
				2165					2170					2175			
cgc	tgg	ctg	gcc	gac	gcc	gga	gcc	gaa	cat	gtg	gcg	atg	gtg	agt	cga		6576

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Arg	Trp	Leu	Ala	Asp	Ala	Gly	Ala	Glu	His	Val	Ala	Met	Val	Ser	Arg	
		2180						2185					2190			
cgc	ggc	gag	cag	gca	ccg	agt	gct	gag	aag	ttg	cgg	acg	gaa	ctg	gag	6624
Arg	Gly	Glu	Gln	Ala	Pro	Ser	Ala	Glu	Lys	Leu	Arg	Thr	Glu	Leu	Glu	
		2195					2200					2205				
gat	ctg	ggt	acc	cgg	gtg	tcg	atc	gtg	tca	tgc	gat	gtg	acc	gat	cgc	6672
Asp	Leu	Gly	Thr	Arg	Val	Ser	Ile	Val	Ser	Cys	Asp	Val	Thr	Asp	Arg	
		2210				2215					2220					
gag	gcg	ctc	gcc	gaa	gtg	ctg	aaa	gcc	ctt	ccg	gct	gaa	aac	ccg	ttg	6720
Glu	Ala	Leu	Ala	Glu	Val	Leu	Lys	Ala	Leu	Pro	Ala	Glu	Asn	Pro	Leu	
2225					2230					2235					2240	
acc	gcg	gta	gtg	cat	gcg	gca	ggc	gtg	atc	gag	act	ggt	gat	gcg	gcg	6768
Thr	Ala	Val	Val	His	Ala	Ala	Gly	Val	Ile	Glu	Thr	Gly	Asp	Ala	Ala	
				2245					2250					2255		
gca	atg	agc	ctg	gct	gat	ttc	gat	cac	gtg	ttg	tcc	gca	aag	gtg	gcc	6816
Ala	Met	Ser	Leu	Ala	Asp	Phe	Asp	His	Val	Leu	Ser	Ala	Lys	Val	Ala	
			2260					2265					2270			
ggt	gcc	gcg	aat	ctg	gat	gcc	ttg	ttg	gcc	gat	gtg	gaa	ttg	gac	gcg	6864
Gly	Ala	Ala	Asn	Leu	Asp	Ala	Leu	Leu	Ala	Asp	Val	Glu	Leu	Asp	Ala	
		2275					2280					2285				
ttc	gtc	ttg	ttc	tca	tcg	gtg	tca	gga	gtt	tgg	ggc	gct	ggg	gga	cac	6912
Phe	Val	Leu	Phe	Ser	Ser	Val	Ser	Gly	Val	Trp	Gly	Ala	Gly	Gly	His	
	2290					2295					2300					
ggg	gct	tac	gca	gcg	gcg	aat	gcc	tat	ctg	gat	gcg	ctc	gcg	gaa	cag	6960
Gly	Ala	Tyr	Ala	Ala	Ala	Asn	Ala	Tyr	Leu	Asp	Ala	Leu	Ala	Glu	Gln	
2305					2310					2315					2320	
cgt	cgg	tcg	cga	ggg	ctg	gtc	gcg	act	gcg	gtg	gcc	tgg	ggg	ccg	tgg	7008
Arg	Arg	Ser	Arg	Gly	Leu	Val	Ala	Thr	Ala	Val	Ala	Trp	Gly	Pro	Trp	
				2325					2330					2335		
gcc	ggc	gag	ggc	atg	gcc	tcc	gga	gaa	aca	gga	gac	cag	ctg	cgc	cga	7056
Ala	Gly	Glu	Gly	Met	Ala	Ser	Gly	Glu	Thr	Gly	Asp	Gln	Leu	Arg	Arg	
			2340					2345					2350			
tac	ggc	ctt	tcc	cca	atg	gct	ccg	cag	cac	gcc	atc	gcc	gga	atc	cgg	7104
Tyr	Gly	Leu	Ser	Pro	Met	Ala	Pro	Gln	His	Ala	Ile	Ala	Gly	Ile	Arg	
		2355					2360					2365				
cag	gcc	gtg	gaa	cag	gac	gaa	att	tcc	ctg	gta	gtg	gcc	gat	gtc	gat	7152
Gln	Ala	Val	Glu	Gln	Asp	Glu	Ile	Ser	Leu	Val	Val	Ala	Asp	Val	Asp	
		2370				2375					2380					
tgg	gca	cgt	ttc	agc	gcg	gga	ttg	ctg	gcg	gct	agg	ccg	cgg	ccg	ctg	7200
Trp	Ala	Arg	Phe	Ser	Ala	Gly	Leu	Leu	Ala	Ala	Arg	Pro	Arg	Pro	Leu	
2385					2390					2395					2400	
ctg	aac	gaa	ctg	gcc	gag	gtc	aag	gaa	ctc	ctc	gtc	gat	gcc	cag	ccc	7248
Leu	Asn	Glu	Leu	Ala	Glu	Val	Lys	Glu	Leu	Leu	Val	Asp	Ala	Gln	Pro	
				2405					2410					2415		
gag	gcg	gga	gtc	ctt	gcc	gac	gcg	tcg	ttg	gaa	tgg	cgg	cag	cga	ttg	7296
Glu	Ala	Gly	Val	Leu	Ala	Asp	Ala	Ser	Leu	Glu	Trp	Arg	Gln	Arg	Leu	
		2420						2425					2430			

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tcc gcg gca ccg agg ccg aca cag gaa cag ctg atc ctg gag ctg gta Ser Ala Ala Pro Arg Pro Thr Gln Glu Gln Leu Ile Leu Glu Leu Val 2435 2440 2445	7344
cgc ggc gaa acc gct ctg gtg ctg gga cac ccc ggg gca gcg gcc gtt Arg Gly Glu Thr Ala Leu Val Leu Gly His Pro Gly Ala Ala Ala Val 2450 2455 2460	7392
gca tcg gaa cga gcc ttc aag gac agc gga ttc gac tcg cag gcc gcg Ala Ser Glu Arg Ala Phe Lys Asp Ser Gly Phe Asp Ser Gln Ala Ala 2465 2470 2475 2480	7440
gtc gaa ctc cgc gtt cgg ctc aat cga gct acc ggc ctc cag ttg cca Val Glu Leu Arg Val Arg Leu Asn Arg Ala Thr Gly Leu Gln Leu Pro 2485 2490 2495	7488
tcg aca att atc ttc agc cat ccc acg cct gcg gaa ctg gct gcg gag Ser Thr Ile Ile Phe Ser His Pro Thr Pro Ala Glu Leu Ala Ala Glu 2500 2505 2510	7536
ctg cgg gcg agg ctt ctt ccc gag tcc gca gga gca ggc att ccc gag Leu Arg Ala Arg Leu Leu Pro Glu Ser Ala Gly Ala Gly Ile Pro Glu 2515 2520 2525	7584
gag gac gag gcg cga atc aga gcg gca ctg acg tcg atc ccg ttc ccg Glu Asp Glu Ala Arg Ile Arg Ala Ala Leu Thr Ser Ile Pro Phe Pro 2530 2535 2540	7632
gcc ttg cgc gag gca ggc ttg gtg agt ccg ctg ctc gca ctt gcc gga Ala Leu Arg Glu Ala Gly Leu Val Ser Pro Leu Leu Ala Leu Ala Gly 2545 2550 2555 2560	7680
cac ccg gtc gac tcc ggt atc tcc tcg gac gat gcg gcc gcg acc tcg His Pro Val Asp Ser Gly Ile Ser Ser Ser Asp Asp Ala Ala Ala Thr Ser 2565 2570 2575	7728
atc gat gcg atg gat gta gcc ggc ctc gtc gaa gca gcg ctg ggc gaa Ile Asp Ala Met Asp Val Ala Gly Leu Val Glu Ala Ala Leu Gly Glu 2580 2585 2590	7776
cgc gag tcc tga Arg Glu Ser 2595	7788

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 <212> PRT  
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<400> 42  
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 Leu Pro Gln Ala Pro Asp Pro Ala Ser Phe Trp Arg Leu Leu Arg Thr  
 20 25 30  
 Gly Thr Asp Ala Ile Thr Thr Val Pro Glu Gly Arg Trp Gly Asp Pro  
 35 40 45  
 Leu Pro Gly Arg Asp Ala Pro Lys Gly Pro Glu Trp Gly Gly Phe Leu  
 50 55 60

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Ala	Asp	Val	Asp	Cys	Phe	Asp	Pro	Glu	Phe	Phe	Gly	Ile	Ser	Pro	Arg
65					70					75					80
Glu	Ala	Ala	Ala	Val	Asp	Pro	Gln	Gln	Arg	Leu	Ala	Leu	Glu	Leu	Ala
				85					90					95	
Trp	Glu	Ala	Leu	Glu	Asp	Ala	Gly	Ile	Pro	Ala	Gly	Glu	Leu	Arg	Gly
			100					105					110		
Thr	Ala	Ala	Gly	Val	Phe	Met	Gly	Ala	Ile	Ser	Asp	Asp	Tyr	Ala	Ala
		115					120					125			
Leu	Leu	Arg	Glu	Ser	Pro	Pro	Glu	Val	Ala	Ala	Gln	Tyr	Arg	Leu	Thr
	130					135					140				
Gly	Thr	His	Arg	Ser	Leu	Ile	Ala	Asn	Arg	Val	Ser	Tyr	Val	Leu	Gly
145					150					155					160
Leu	Arg	Gly	Pro	Ser	Leu	Thr	Val	Asp	Ser	Gly	Gln	Ser	Ser	Ser	Leu
				165					170					175	
Val	Gly	Val	His	Leu	Ala	Ser	Glu	Ser	Leu	Arg	Arg	Gly	Glu	Cys	Thr
			180					185					190		
Ile	Ala	Leu	Ala	Gly	Gly	Val	Asn	Leu	Asn	Leu	Ala	Ala	Glu	Ser	Asn
		195					200					205			
Ser	Ala	Leu	Met	Asp	Phe	Gly	Ala	Leu	Ser	Pro	Asp	Gly	Arg	Cys	Phe
	210					215					220				
Thr	Phe	Asp	Val	Arg	Ala	Asn	Gly	Tyr	Val	Arg	Gly	Glu	Gly	Gly	Gly
225					230					235					240
Leu	Val	Val	Leu	Lys	Lys	Ala	Asp	Gln	Ala	His	Ala	Asp	Gly	Asp	Arg
				245					250					255	
Ile	Tyr	Cys	Leu	Ile	Arg	Gly	Ser	Ala	Val	Asn	Asn	Asp	Gly	Gly	Gly
			260					265					270		
Ala	Gly	Leu	Thr	Val	Pro	Ala	Ala	Asp	Ala	Gln	Ala	Glu	Leu	Leu	Arg
		275					280					285			
Gln	Ala	Tyr	Arg	Asn	Ala	Gly	Val	Asp	Pro	Ala	Ala	Val	Gln	Tyr	Val
	290					295					300				
Glu	Leu	His	Gly	Ser	Ala	Thr	Arg	Val	Gly	Asp	Pro	Val	Glu	Ala	Ala
305					310					315					320
Ala	Leu	Gly	Ala	Val	Leu	Gly	Ala	Ala	Arg	Arg	Pro	Gly	Asp	Glu	Leu
				325					330					335	
Arg	Val	Gly	Ser	Ala	Lys	Thr	Asn	Val	Gly	His	Leu	Glu	Ala	Ala	Ala
			340					345					350		
Gly	Val	Thr	Gly	Leu	Leu	Lys	Thr	Ala	Leu	Ser	Ile	Trp	His	Arg	Glu
		355					360					365			
Leu	Pro	Pro	Ser	Leu	His	Phe	Thr	Ala	Pro	Asn	Pro	Glu	Ile	Pro	Leu
	370					375					380				
Asp	Glu	Leu	Asn	Leu	Arg	Val	Gln	Arg	Asp	Leu	Arg	Pro	Trp	Pro	Glu
385					390					395					400



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Ser	Glu	Gly	Pro	Leu	Leu	Ala	Gly	Val	Ser	Ala	Phe	Gly	Met	Gly	Gly
				405					410					415	
Thr	Asn	Cys	His	Leu	Val	Leu	Ser	Gly	Thr	Ser	Arg	Val	Glu	Arg	Arg
			420					425					430		
Arg	Ser	Gly	Pro	Ala	Glu	Ala	Thr	Met	Pro	Trp	Val	Leu	Ser	Ala	Arg
		435					440					445			
Thr	Pro	Val	Ala	Leu	Arg	Ala	Gln	Ala	Ala	Arg	Leu	His	Thr	His	Leu
	450					455					460				
Asn	Thr	Ala	Gly	Gln	Ser	Pro	Leu	Asp	Val	Ala	Tyr	Ser	Leu	Ala	Thr
465					470					475					480
Thr	Arg	Ser	Ala	Leu	Pro	His	Arg	Ala	Ala	Leu	Val	Ala	Asp	Asp	Glu
				485					490					495	
Pro	Lys	Leu	Leu	Ala	Gly	Leu	Lys	Ala	Leu	Ala	Asp	Gly	Asp	Asp	Ala
			500					505					510		
Pro	Thr	Leu	Cys	His	Gly	Ala	Thr	Ser	Gly	Glu	Arg	Ala	Ala	Val	Phe
		515					520					525			
Val	Phe	Pro	Gly	Gln	Gly	Ser	Gln	Trp	Ile	Gly	Met	Gly	Arg	Gln	Leu
	530					535					540				
Leu	Glu	Thr	Ser	Glu	Val	Phe	Ala	Ala	Ser	Met	Ser	Asp	Cys	Ala	Asp
545					550					555					560
Ala	Leu	Ala	Pro	His	Leu	Asp	Trp	Ser	Leu	Leu	Asp	Val	Leu	Arg	Asn
				565					570					575	
Ala	Ala	Gly	Ala	Ala	His	Leu	Asp	His	Asp	Asp	Val	Val	Gln	Pro	Ala
			580					585					590		
Leu	Phe	Ala	Ile	Met	Val	Ser	Leu	Ala	Glu	Leu	Trp	Arg	Ser	Trp	Gly
		595					600					605			
Val	Arg	Pro	Val	Ala	Val	Val	Gly	His	Ser	Gln	Gly	Glu	Ile	Ala	Ala
	610					615					620				
Ala	Cys	Val	Ala	Gly	Ala	Leu	Ser	Val	Arg	Asp	Ala	Ala	Arg	Val	Val
625					630					635					640
Ala	Val	Arg	Ser	Arg	Leu	Leu	Thr	Ala	Leu	Ala	Gly	Ser	Gly	Ala	Met
				645					650					655	
Ala	Ser	Leu	Gln	His	Pro	Ala	Glu	Glu	Val	Arg	Gln	Ile	Leu	Leu	Pro
			660					665					670		
Trp	Arg	Asp	Arg	Ile	Gly	Val	Ala	Gly	Val	Asn	Gly	Pro	Ser	Ser	Thr
		675					680					685			
Leu	Val	Ser	Gly	Asp	Arg	Glu	Ala	Met	Ala	Glu	Leu	Leu	Ala	Glu	Cys
	690					695					700				
Ala	Asp	Arg	Glu	Leu	Arg	Met	Arg	Arg	Ile	Pro	Val	Glu	Tyr	Ala	Ser
705					710					715					720
His	Ser	Pro	His	Ile	Glu	Val	Val	Arg	Asp	Glu	Leu	Leu	Gly	Leu	Leu
				725					730					735	

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Ala	Pro	Val	Glu	Pro	Arg	Thr	Gly	Ser	Ile	Pro	Ile	Tyr	Ser	Thr	Thr
			740					745					750		
Thr	Gly	Asp	Leu	Leu	Asp	Arg	Pro	Met	Asp	Ala	Asp	Tyr	Trp	Tyr	Arg
		755					760					765			
Asn	Leu	Arg	Gln	Pro	Val	Leu	Phe	Glu	Ala	Ala	Val	Glu	Ala	Leu	Leu
	770					775					780				
Lys	Arg	Gly	Tyr	Asp	Ala	Phe	Ile	Glu	Ile	Ser	Pro	His	Pro	Val	Leu
785					790					795					800
Thr	Ala	Asn	Ile	Gln	Glu	Thr	Ala	Val	Arg	Ala	Gly	Arg	Glu	Val	Val
				805					810					815	
Ala	Leu	Gly	Thr	Leu	Arg	Arg	Gly	Glu	Gly	Gly	Met	Arg	Gln	Ala	Leu
			820					825					830		
Thr	Ser	Leu	Ala	Arg	Ala	His	Val	His	Gly	Val	Ala	Ala	Asp	Trp	His
		835					840					845			
Ala	Val	Phe	Ala	Gly	Thr	Gly	Ala	Gln	Arg	Val	Asp	Leu	Pro	Thr	Tyr
	850					855					860				
Ala	Phe	Gln	Arg	Gln	Arg	Tyr	Trp	Leu	Asp	Ala	Lys	Leu	Pro	Asp	Val
865					870					875					880
Ala	Met	Pro	Glu	Ser	Asp	Val	Ser	Thr	Ala	Leu	Arg	Glu	Lys	Leu	Arg
				885					890					895	
Ser	Ser	Pro	Arg	Ala	Asp	Val	Asp	Ser	Thr	Thr	Leu	Thr	Met	Ile	Arg
			900					905					910		
Ala	Gln	Ala	Ala	Val	Val	Leu	Gly	His	Ser	Asp	Pro	Lys	Glu	Val	Asp
		915					920					925			
Pro	Asp	Arg	Thr	Phe	Lys	Asp	Leu	Gly	Phe	Asp	Ser	Ser	Met	Val	Val
	930					935					940				
Glu	Leu	Cys	Asp	Arg	Leu	Asn	Ala	Ala	Thr	Gly	Leu	Arg	Leu	Ala	Pro
945					950					955					960
Ser	Val	Val	Phe	Asp	Cys	Pro	Thr	Pro	Asp	Lys	Leu	Ala	Arg	Gln	Val
				965					970					975	
Arg	Thr	Leu	Leu	Leu	Gly	Glu	Pro	Ala	Pro	Met	Thr	Ser	His	Arg	Pro
		980						985					990		
Asp	Ser	Asp	Ala	Asp	Glu	Pro	Ile	Ala	Val	Ile	Gly	Met	Gly	Cys	Arg
		995					1000					1005			
Phe	Pro	Gly	Gly	Val	Ser	Ser	Pro	Glu	Glu	Leu	Trp	Gln	Leu	Val	Ala
	1010					1015					1020				
Ala	Gly	Arg	Asp	Val	Val	Ser	Glu	Phe	Pro	Ala	Asp	Arg	Gly	Trp	Asp
025					1030					1035					1040
Leu	Glu	Arg	Ala	Gly	Thr	Ser	His	Val	Arg	Ala	Gly	Gly	Phe	Leu	His
				1045					1050					1055	
Gly	Ala	Pro	Asp	Phe	Asp	Pro	Gly	Phe	Phe	Arg	Ile	Ser	Pro	Arg	Glu
			1060					1065					1070		

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Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu Glu Ile Ala Trp  
1075 1080 1085

Glu Ala Val Glu Arg Gly Gly Ile Asn Pro Gln His Leu His Gly Ser  
1090 1095 1100

Gln Thr Gly Val Phe Val Gly Ala Thr Ser Leu Asp Tyr Gly Pro Arg  
1105 1110 1115 1120

Leu His Glu Ala Ser Glu Glu Ala Ala Gly Tyr Val Leu Thr Gly Ser  
1125 1130 1135

Thr Thr Ser Val Ala Ser Gly Arg Val Ala Tyr Ser Phe Gly Phe Glu  
1140 1145 1150

Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala  
1155 1160 1165

Leu His Leu Ala Cys Gln Ser Leu Arg Ser Gly Glu Cys Asp Leu Ala  
1170 1175 1180

Leu Ala Gly Gly Val Thr Val Met Ala Thr Pro Gly Met Phe Val Glu  
1185 1190 1195 1200

Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg Cys Lys Ser Phe  
1205 1210 1215

Ala Glu Ala Ala Asp Gly Thr Gly Trp Ser Glu Gly Ala Gly Leu Val  
1220 1225 1230

Leu Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly His Glu Val Leu  
1235 1240 1245

Ala Val Val Arg Gly Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly  
1250 1255 1260

Leu Thr Ala Pro Asn Gly Ser Ser Gln Gln Arg Val Ile Ala Gln Ala  
1265 1270 1275 1280

Leu Ala Ser Ala Gly Leu Ser Val Ser Asp Val Asp Ala Val Glu Ala  
1285 1290 1295

His Gly Thr Gly Thr Arg Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu  
1300 1305 1310

Ile Ala Thr Tyr Gly Gln Gly Arg Leu Pro Glu Arg Pro Leu Trp Leu  
1315 1320 1325

Gly Ser Met Lys Ser Asn Ile Gly His Ala Gln Ala Ala Ala Gly Ile  
1330 1335 1340

Ala Gly Val Met Lys Met Val Met Ala Met Arg His Gly Gln Leu Pro  
1345 1350 1355 1360

Arg Thr Leu His Val Asp Glu Pro Thr Ser Gly Val Asp Trp Ser Ala  
1365 1370 1375

Gly Thr Val Gln Leu Leu Thr Glu Asn Thr Pro Trp Pro Gly Ser Gly  
1380 1385 1390

Arg Val Arg Arg Val Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn  
1395 1400 1405

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Ala His Val Ile Leu Glu Gln Pro Pro Gly Val Pro Ser Gln Ser Ala  
1410 1415 1420

Gly Pro Gly Ser Gly Ser Val Val Asp Val Pro Val Val Pro Trp Met  
425 1430 1435 1440

Val Ser Gly Lys Thr Pro Glu Ala Leu Ser Ala Gln Ala Thr Ala Leu  
1445 1450 1455

Met Thr Tyr Leu Asp Glu Arg Pro Asp Val Ser Ser Leu Asp Val Gly  
1460 1465 1470

Tyr Ser Leu Ala Leu Thr Arg Ser Ala Leu Asp Glu Arg Ala Val Val  
1475 1480 1485

Leu Gly Ser Asp Arg Glu Thr Leu Leu Cys Gly Val Lys Ala Leu Ser  
1490 1495 1500

Ala Gly His Glu Ala Ser Gly Leu Val Thr Gly Ser Val Gly Ala Gly  
505 1510 1515 1520

Gly Arg Ile Gly Phe Val Phe Ser Gly Gln Gly Gly Gln Trp Leu Gly  
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Met Gly Arg Gly Leu Tyr Arg Ala Phe Pro Val Phe Ala Ala Ala Phe  
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Asp Glu Ala Cys Ala Glu Leu Asp Ala His Leu Gly Gln Glu Ile Gly  
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Val Arg Glu Val Val Ser Gly Ser Asp Ala Gln Leu Leu Asp Arg Thr  
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Leu Trp Ala Gln Ser Gly Leu Phe Ala Leu Gln Val Gly Leu Leu Lys  
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Leu Leu Asp Ser Trp Gly Val Arg Pro Ser Val Val Leu Gly His Ser  
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Val Gly Glu Leu Ala Ala Ala Phe Ala Ala Gly Val Val Ser Leu Ser  
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Gly Ala Ala Arg Leu Val Ala Gly Arg Ala Arg Leu Met Gln Ala Leu  
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Pro Ser Gly Gly Gly Met Leu Ala Val Pro Ala Gly Glu Glu Leu Leu  
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Trp Ser Leu Leu Ala Asp Gln Gly Asp Arg Val Gly Ile Ala Ala Val  
665 1670 1675 1680

Asn Ala Ala Gly Ser Val Val Leu Ser Gly Asp Arg Asp Val Leu Asp  
1685 1690 1695

Asp Leu Ala Gly Arg Leu Asp Gly Gln Gly Ile Arg Ser Arg Trp Leu  
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Arg Val Ser His Ala Phe His Ser Tyr Arg Met Asp Pro Met Leu Ala  
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Glu Phe Ala Glu Leu Ala Arg Thr Val Asp Tyr Arg Arg Cys Glu Val  
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Pro Ile Val Ser Thr Leu Thr Gly Asp Leu Asp Asp Ala Gly Arg Met  
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 Ser Gly Pro Asp Tyr Trp Val Arg Gln Val Arg Glu Pro Val Arg Phe  
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 Ala Asp Gly Val Gln Ala Leu Val Glu His Asp Val Ala Thr Val Val  
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 Glu Leu Gly Pro Asp Gly Ala Leu Ser Ala Leu Ile Gln Glu Cys Val  
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 Ala Ala Ser Asp His Ala Gly Arg Leu Ser Ala Val Pro Ala Met Arg  
 1810 1815 1820  
 Arg Asn Gln Asp Glu Ala Gln Lys Val Met Thr Ala Leu Ala His Val  
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 His Val Arg Gly Gly Ala Val Asp Trp Arg Ser Phe Phe Ala Gly Thr  
 1845 1850 1855  
 Arg Ala Lys Gln Ile Glu Leu Pro Thr Tyr Ala Phe Gln Arg Gln Arg  
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 Tyr Trp Leu Asn Ala Leu Arg Glu Ser Ser Ala Gly Asp Met Gly Arg  
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 Arg Val Glu Ala Lys Phe Trp Gly Ala Val Glu His Glu Asp Val Glu  
 1890 1895 1900  
 Ser Leu Ala Arg Val Leu Gly Ile Val Asp Asp Gly Ala Ala Val Asp  
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 1955 1960 1965  
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 985 1990 1995 2000  
 Asp Pro Asp Pro Thr Ser Phe Gly Asp Arg Val Arg Thr Leu Cys Ser  
 2005 2010 2015  
 Gly Leu Pro Asp Leu Val Gly Val Leu Ser Met Leu Cys Leu Glu Glu  
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 Ser Val Leu Pro Gly Phe Ser Ala Val Ser Arg Gly Phe Ala Leu Thr  
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 Val Glu Leu Val Arg Val Leu Arg Ala Ala Gly Ala Thr Ala Arg Leu  
 2050 2055 2060  
 Trp Leu Leu Thr Cys Gly Gly Val Ser Val Gly Asp Val Pro Val Arg  
 065 2070 2075 2080

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Pro Ala Gln Ala Leu Ala Trp Gly Leu Gly Arg Val Val Gly Leu Glu  
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His Pro Asp Trp Trp Gly Gly Leu Ile Asp Ile Pro Val Leu Phe Asp  
2100 2105 2110

Glu Asp Ala Gln Glu Arg Leu Ser Ile Val Leu Ala Gly Leu Asp Glu  
2115 2120 2125

Asp Glu Val Ala Ile Arg Pro Asp Gly Met Phe Ala Arg Arg Leu Val  
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Arg His Thr Val Ser Ala Asp Val Lys Lys Ala Trp Arg Pro Arg Gly  
145 2150 2155 2160

Ser Val Leu Val Thr Gly Gly Thr Gly Gly Leu Gly Ala His Val Ala  
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Arg Trp Leu Ala Asp Ala Gly Ala Glu His Val Ala Met Val Ser Arg  
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Arg Gly Glu Gln Ala Pro Ser Ala Glu Lys Leu Arg Thr Glu Leu Glu  
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Asp Leu Gly Thr Arg Val Ser Ile Val Ser Cys Asp Val Thr Asp Arg  
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Glu Ala Leu Ala Glu Val Leu Lys Ala Leu Pro Ala Glu Asn Pro Leu  
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Thr Ala Val Val His Ala Ala Gly Val Ile Glu Thr Gly Asp Ala Ala  
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Ala Met Ser Leu Ala Asp Phe Asp His Val Leu Ser Ala Lys Val Ala  
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Gly Ala Ala Asn Leu Asp Ala Leu Leu Ala Asp Val Glu Leu Asp Ala  
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Phe Val Leu Phe Ser Ser Val Ser Gly Val Trp Gly Ala Gly Gly His  
2290 2295 2300

Gly Ala Tyr Ala Ala Ala Asn Ala Tyr Leu Asp Ala Leu Ala Glu Gln  
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Arg Arg Ser Arg Gly Leu Val Ala Thr Ala Val Ala Trp Gly Pro Trp  
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Ala Gly Glu Gly Met Ala Ser Gly Glu Thr Gly Asp Gln Leu Arg Arg  
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Tyr Gly Leu Ser Pro Met Ala Pro Gln His Ala Ile Ala Gly Ile Arg  
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Gln Ala Val Glu Gln Asp Glu Ile Ser Leu Val Val Ala Asp Val Asp  
2370 2375 2380

Trp Ala Arg Phe Ser Ala Gly Leu Leu Ala Ala Arg Pro Arg Pro Leu  
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Leu Asn Glu Leu Ala Glu Val Lys Glu Leu Leu Val Asp Ala Gln Pro  
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Glu Ala Gly Val Leu Ala Asp Ala Ser Leu Glu Trp Arg Gln Arg Leu  
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Ser Ala Ala Pro Arg Pro Thr Gln Glu Gln Leu Ile Leu Glu Leu Val  
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tcg ctc aag gag aac gaa cgc ctc cgg cgc ggc agg gat cgg ttc tcc 96  
Ser Leu Lys Glu Asn Glu Arg Leu Arg Gly Arg Asp Arg Phe Ser  
20 25 30  
gcg gag aag gac gat ccc atc gcg atc gtg gcg atg agt tgt cgt tat 144  
Ala Glu Lys Asp Asp Pro Ile Ala Ile Val Ala Met Ser Cys Arg Tyr  
35 40 45  
ccc ggt cag gtc tcc tcg ccg gag gac ctg tgg caa ctg gct gcc ggc 192  
Pro Gly Gln Val Ser Ser Pro Glu Asp Leu Trp Gln Leu Ala Ala Gly

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gat Asp	ggc Gly	gtg Val	ttc Phe	gtt Val 85	ccg Pro	gac Asp	tcc Ser	gat Asp	cgt Arg 90	cct Pro	ggc Gly	acg Thr	tcg Ser	tat Tyr 95	gcc Ala	288
tgc Cys	gcg Ala	ggc Gly	ggt Gly 100	ttt Phe	ctt Leu	cag Gln	ggc Gly	gtg Val 105	tcg Ser	gag Glu	ttc Phe	gac Asp	gcg Ala 110	ggt Gly	ttc Phe	336
ttc Phe	ggg Gly 115	att Ile	tcg Ser	ccg Pro	cgt Arg	gag Glu	gcg Ala 120	ctg Leu	gcg Ala	atg Met	gat Asp	ccg Pro 125	cag Gln	cag Gln	cgg Arg	384
ttg Leu 130	ctg Leu	ctg Leu	gaa Glu	gtc Val	gcg Ala	tgg Trp 135	gag Glu	gtc Val	ttc Phe	gag Glu	cgg Arg 140	gct Ala	ggg Gly	ctg Leu	gag Glu	432
cag Gln 145	cgg Arg	tcg Ser	aca Thr	cgc Arg	ggt Gly 150	tcc Ser	cgc Arg	gtt Val	ggc Gly	gtg Val 155	ttc Phe	gtc Val	ggc Gly	acc Thr	aat Asn 160	480
ggc Gly	cag Gln	gac Asp	tac Tyr	gcg Ala 165	tcg Ser	tgg Trp	ttg Leu	cgg Arg	acg Thr 170	ccg Pro	ccg Pro	cct Pro	gcg Ala	gtg Val 175	gca Ala	528
ggt Gly	cat His	gtg Val	ctg Leu 180	acg Thr	ggc Gly	ggt Gly	gcg Ala	gca Ala 185	gcg Ala	gtt Val	ctt Leu	tcg Ser	ggc Gly 190	cgg Arg	gtt Val	576
gcg Ala	tat Tyr	tcg Ser 195	ttc Phe	ggg Gly	ttc Phe	gag Glu	ggt Gly 200	cct Pro	gcg Ala	gtg Val	acg Thr	gtg Val 205	gat Asp	acg Thr	gcg Ala	624
tgt Cys	tcg Ser 210	tcg Ser	tcg Ser	ttg Leu	gtg Val	gcg Ala 215	ttg Leu	cac His	ctg Leu	gcg Ala	ggg Gly 220	caa Gln	gca Ala	ctg Leu	cgg Arg	672
gcc Ala 225	ggt Gly	gag Glu	tgc Cys	gac Asp	ctt Leu 230	gcc Ala	ctt Leu	gcc Ala	ggt Gly	ggc Gly 235	gtc Val	acg Thr	gtg Val	atg Met	tcg Ser 240	720
acg Thr	ccg Pro	aag Lys	gtg Val	ttc Phe 245	ctg Leu	gag Glu	ttc Phe	tcc Ser	cgc Arg 250	caa Gln	cgg Arg	ggt Gly	ctc Leu	gcg Ala 255	ccg Pro	768
gat Asp	ggg Gly	cgg Arg	tgc Cys 260	aag Lys	tcg Ser	ttc Phe	gcg Ala	gcg Ala 265	ggt Gly	gcg Ala	gat Asp	ggc Gly	act Thr 270	gga Gly	tgg Trp	816
ggt Gly	gag Glu	ggt Gly 275	gcc Ala	gga Gly	ctg Leu	ttg Leu	ttg Leu 280	ctg Leu	gag Glu	cgg Arg	ttg Leu	tcg Ser 285	gat Asp	gcc Ala	cgg Arg	864
cgg Arg 290	aat Asn	ggg Gly	cat His	gag Glu	gtg Val 295	ctg Leu	gcg Ala	gtt Val	gtt Val	cgt Arg	ggt Gly 300	agt Ser	gcg Ala	gtg Val	aat Asn	912
cag	gac	ggt	gcg	tcg	aat	ggt	ttg	acc	gcg	ccg	aat	ggt	tcg	tcg	cag	960



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Gln 305	Asp	Gly	Ala	Ser	Asn 310	Gly	Leu	Thr	Ala	Pro 315	Asn	Gly	Ser	Ser	Gln 320
cag Gln	cgg Arg	gtg Val	att Ile	acc Thr 325	cag Gln	gcg Ala	ttg Leu	gcg Ala	agt Ser 330	gcg Ala	ggg Gly	ttg Leu	tcg Ser	gtg Val 335	tcc Ser
gat Asp	gtg Val	gat Asp	gct Ala 340	gtg Val	gag Glu	gcg Ala	cat His	ggg Gly 345	acg Thr	ggc Gly	acg Thr	cgg Arg	ctt Leu 350	ggt Gly	gat Asp
ccg Pro	atc Ile	gag Glu 355	gcg Ala	cag Gln	gcg Ala	ctg Leu	atc Ile 360	gcc Ala	acc Thr	tac Tyr	ggc Gly 365	cgt Arg	gat Asp	cgt Arg	gat Asp
cct Pro	ggc Gly 370	cgg Arg	ccg Pro	ttg Leu	tgg Trp	ttg Leu 375	ggg Gly	tcg Ser	gtc Val	aag Lys	tcg Ser 380	aac Asn	atc Ile	ggt Gly	cat His
acg Thr 385	caa Gln	gcg Ala	gcg Ala	gcg Ala	ggt Gly 390	gtg Val	gct Ala	ggt Gly	gtg Val	atc Ile 395	aag Lys	atg Met	gtg Val	atg Met	gcg Ala 400
atg Met	cgg Arg	cac His	ggg Gly 405	cag Gln	ctg Leu	cca Pro	cgc Arg	acg Thr 410	ttg Leu	cac His	gtg Val	gaa Glu	tcg Ser	ccg Pro 415	tcg Ser
ccg Pro	gag Glu	gtg Val	gat Asp 420	tgg Trp	tcg Ser	gcg Ala	ggg Gly	acg Thr 425	gtt Val	caa Gln	ctc Leu	ctt Leu 430	acg Thr	gag Glu	aac Asn
acg Thr	ccc Pro	tgg Trp 435	ccc Pro	agg Arg	agt Ser	ggt Gly	cgt Arg 440	gtt Val	cgt Arg	cgg Arg	gtg Val	ggg Gly 445	gtg Val	tcg Ser	tcg Ser
ttc Phe	ggg Gly 450	atc Ile	agt Ser	ggt Gly	act Thr	aac Asn 455	gcg Ala	cac His	gtc Val	atc Ile 460	ctc Leu	gaa Glu	cag Gln	ccc Pro	ccg Pro
gga Gly 465	gtg Val	ccg Pro	agt Ser	cag Gln	tct Ser 470	gcg Ala	ggg Gly	ccg Pro	ggt Gly	tcg Ser 475	ggt Gly	tct Ser	gtc Val	gtg Val	gat Asp 480
gtt Val	ccg Pro	gtg Val	gtg Val	ccg Pro 485	tgg Trp	atg Met	gtg Val	tcg Ser	ggc Gly 490	aaa Lys	aca Thr	ccc Pro	gaa Glu	gcg Ala 495	cta Leu
tcc Ser	gcg Ala	cag Gln	gca Ala 500	acg Thr	gcg Ala	ttg Leu	atg Met	acc Thr 505	tat Tyr	ctg Leu	gac Asp	gag Glu 510	cga Arg	cct Pro	gat Asp
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ctg Leu	gat Asp 530	gag Glu	cga Arg	gcg Ala	gtg Val	gtg Val 535	ctg Leu	ggg Gly	tcg Ser	gac Asp	cgt Arg 540	gaa Glu	acg Thr	ttg Leu	ttg Leu
tgc Cys 545	ggt Gly	gtg Val	aaa Lys	gcg Ala	ctg Leu 550	tct Ser	gcc Ala	ggt Gly	cat His	gag Glu 555	gct Ala	tct Ser	ggg Gly	ttg Leu	gtg Val 560

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acc	gga	tct	gtg	ggg	gct	ggg	ggc	cgc	atc	ggg	ttt	gtg	ttt	tcc	ggt	
Thr	Gly	Ser	Val	Gly	Ala	Gly	Gly	Arg	Ile	Gly	Phe	Val	Phe	Ser	Gly	1728
				565					570					575		
cag	ggt	ggt	cag	tgg	ctg	ggg	atg	ggc	cgg	ggg	ctt	tac	cgg	gct	ttt	1776
Gln	Gly	Gly	Gln	Trp	Leu	Gly	Met	Gly	Arg	Gly	Leu	Tyr	Arg	Ala	Phe	
			580					585					590			
ccg	gtg	ttc	gct	gct	gcc	ttt	gac	gaa	gct	tgt	gcc	gag	ctg	gat	gca	1824
Pro	Val	Phe	Ala	Ala	Ala	Phe	Asp	Glu	Ala	Cys	Ala	Glu	Leu	Asp	Ala	
		595					600					605				
cat	ctg	ggc	cag	gaa	atc	ggg	gtt	cgg	gag	gtg	gtg	tcc	ggt	tcg	gat	1872
His	Leu	Gly	Gln	Glu	Ile	Gly	Val	Arg	Glu	Val	Val	Ser	Gly	Ser	Asp	
	610					615					620					
gcg	cag	ttg	ctg	gat	cgg	acg	ttg	tgg	gcg	cag	tcg	ggt	ttg	ttc	gcg	1920
Ala	Gln	Leu	Leu	Asp	Arg	Thr	Leu	Trp	Ala	Gln	Ser	Gly	Leu	Phe	Ala	
625					630					635					640	
ttg	cag	gtg	ggc	ttg	ctg	aag	ttg	ctg	gat	tcg	tgg	ggg	gtt	cgg	ccg	1968
Leu	Gln	Val	Gly	Leu	Leu	Lys	Leu	Leu	Asp	Ser	Trp	Gly	Val	Arg	Pro	
				645					650					655		
agt	gtg	gtg	ttg	ggg	cat	tcg	gtg	ggc	gag	ttg	gcg	gcg	gcg	ttc	gcg	2016
Ser	Val	Val	Leu	Gly	His	Ser	Val	Gly	Glu	Leu	Ala	Ala	Ala	Phe	Ala	
			660					665					670			
gcg	ggt	gtg	gtg	tcg	ttg	tcg	ggt	gcg	gct	cgg	ttg	gtg	gcg	ggt	cgt	2064
Ala	Gly	Val	Val	Ser	Leu	Ser	Gly	Ala	Ala	Arg	Leu	Val	Ala	Gly	Arg	
		675					680					685				
gcc	cgg	ttg	atg	cag	gcg	ttg	ccg	tct	ggc	ggt	ggg	atg	ctg	gcg	gtg	2112
Ala	Arg	Leu	Met	Gln	Ala	Leu	Pro	Ser	Gly	Gly	Gly	Met	Leu	Ala	Val	
	690					695					700					
cct	gct	ggt	gag	gag	ctg	ttg	tgg	tcg	ttg	ttg	gcc	gat	cag	ggt	gat	2160
Pro	Ala	Gly	Glu	Glu	Leu	Leu	Trp	Ser	Leu	Leu	Ala	Asp	Gln	Gly	Asp	
705					710					715					720	
cgt	gtg	ggg	atc	gcc	gcg	gtc	aac	gct	gcg	ggg	tcg	gtg	gtg	ctc	tct	2208
Arg	Val	Gly	Ile	Ala	Ala	Val	Asn	Ala	Ala	Gly	Ser	Val	Val	Leu	Ser	
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ggt	gat	cgg	gat	gtg	ctc	gat	gac	ctt	gcc	ggt	cgg	ctg	gac	ggg	caa	2256
Gly	Asp	Arg	Asp	Val	Leu	Asp	Asp	Leu	Ala	Gly	Arg	Leu	Asp	Gly	Gln	
			740					745					750			
ggg	atc	cgg	tcg	agg	tgg	ttg	cgg	gtg	tcg	cat	gcg	ttt	cat	tcg	tat	2304
Gly	Ile	Arg	Ser	Arg	Trp	Leu	Arg	Val	Ser	His	Ala	Phe	His	Ser	Tyr	
		755					760					765				
cgg	atg	gat	ccg	atg	ctg	gcg	gag	ttc	gcc	gaa	ttg	gca	cga	acc	gtg	2352
Arg	Met	Asp	Pro	Met	Leu	Ala	Glu	Phe	Ala	Glu	Leu	Ala	Arg	Thr	Val	
	770					775					780					
gat	tac	cgg	cgt	tgt	gaa	gtg	ccg	atc	gtg	tcg	acc	ttg	acc	gga	gac	2400
Asp	Tyr	Arg	Arg	Cys	Glu	Val	Pro	Ile	Val	Ser	Thr	Leu	Thr	Gly	Asp	
785					790					795					800	
ctc	gat	gac	gct	ggc	agg	atg	agc	ggg	ccc	gac	tac	tgg	gtg	cgt	cag	2448
Leu	Asp	Asp	Ala	Gly	Arg	Met	Ser	Gly	Pro	Asp	Tyr	Trp	Val	Arg	Gln	
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Val	Arg	Glu	Pro	Val	Arg	Phe	Ala	Asp	Gly	Val	Gln	Ala	Leu	Val	Glu	
			820					825					830			
cac	gat	gtg	gcc	act	gtt	gtc	gag	ctc	ggg	ccg	gac	ggg	gcg	ttg	tcg	2544
His	Asp	Val	Ala	Thr	Val	Val	Glu	Leu	Gly	Pro	Asp	Gly	Ala	Leu	Ser	
		835					840					845				
gcg	ctg	atc	cag	gaa	tgt	gtc	gcc	gca	tcc	gat	cac	gcc	ggg	cgg	ctg	2592
Ala	Leu	Ile	Gln	Glu	Cys	Val	Ala	Ala	Ser	Asp	His	Ala	Gly	Arg	Leu	
	850					855					860					
agc	gcg	gtc	ccg	gcg	atg	cgc	agg	aac	cag	gac	gag	gcg	cag	aag	gtg	2640
Ser	Ala	Val	Pro	Ala	Met	Arg	Arg	Asn	Gln	Asp	Glu	Ala	Gln	Lys	Val	
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Met	Thr	Ala	Leu	Ala	His	Val	His	Val	Arg	Gly	Gly	Ala	Val	Asp	Trp	
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cgg	tcg	ttc	ttc	gcc	ggg	acg	gga	gcg	aaa	caa	atc	gag	ctg	ccc	acc	2736
Arg	Ser	Phe	Phe	Ala	Gly	Thr	Gly	Ala	Lys	Gln	Ile	Glu	Leu	Pro	Thr	
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tac	gcc	ttc	caa	cga	cag	cgg	tac	tgg	ctg	gtg	cca	tcg	gat	tcc	ggg	2784
Tyr	Ala	Phe	Gln	Arg	Gln	Arg	Tyr	Trp	Leu	Val	Pro	Ser	Asp	Ser	Gly	
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Asp	Val	Thr	Gly	Ala	Gly	Leu	Ala	Gly	Ala	Glu	His	Pro	Leu	Leu	Gly	
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gct	gtg	gtg	ccg	gtc	gcg	ggg	ggg	gac	gag	gtg	ttg	ctg	acc	ggc	agg	2880
Ala	Val	Val	Pro	Val	Ala	Gly	Gly	Asp	Glu	Val	Leu	Leu	Thr	Gly	Arg	
945					950					955					960	
att	tcg	gtg	cgg	acg	cat	ccg	tgg	ctg	gcc	gaa	cac	cgg	gtg	ctg	ggg	2928
Ile	Ser	Val	Arg	Thr	His	Pro	Trp	Leu	Ala	Glu	His	Arg	Val	Leu	Gly	
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gaa	gtg	atc	gtt	gcg	ggc	acc	gcg	ttg	ctg	gag	atc	gcc	ttg	cac	gcg	2976
Glu	Val	Ile	Val	Ala	Gly	Thr	Ala	Leu	Leu	Glu	Ile	Ala	Leu	His	Ala	
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ggg	gaa	cgt	ctt	ggg	tgt	gaa	cgg	gtg	gaa	gag	ctc	acc	ctg	gaa	gca	3024
Gly	Glu	Arg	Leu	Gly	Cys	Glu	Arg	Val	Glu	Glu	Leu	Thr	Leu	Glu	Ala	
		995				1000						1005				
ccg	ctg	gtc	ctg	ccg	gag	cgc	ggg	gcg	atc	cag	gtt	cag	ctg	cga	gtg	3072
Pro	Leu	Val	Leu	Pro	Glu	Arg	Gly	Ala	Ile	Gln	Val	Gln	Leu	Arg	Val	
	1010					1015					1020					
ggc	gcg	ccc	gag	aat	tcc	gga	cgc	agg	ccg	atg	gcg	ctg	tat	tca	cgc	3120
Gly	Ala	Pro	Glu	Asn	Ser	Gly	Arg	Arg	Pro	Met	Ala	Leu	Tyr	Ser	Arg	
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Pro	Glu	Gly	Ala	Ala	Glu	His	Asp	Trp	Thr	Arg	His	Ala	Thr	Gly	Arg	
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Leu	Ala	Pro	Gly	Arg	Gly	Glu	Ala	Ala	Gly	Asp	Leu	Ala	Asp	Trp	Pro	

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gca gag ctt ggg ctg gag tac ggc ccg atc ttc caa ggg ctc aag gcg Ala Glu Leu Gly Leu Glu Tyr Gly Pro Ile Phe Gln Gly Leu Lys Ala 1090 1095 1100			3312
gcc tgg cgg caa ggg gac gag gtg tac gcc gaa gcc gcg ctg ccg gga Ala Trp Arg Gln Gly Asp Glu Val Tyr Ala Glu Ala Ala Leu Pro Gly 1105 1110 1115 1120			3360
acg gaa gat tct ggt ttc ggg gtg cat ccg gca ctg ctg gac gcg gct Thr Glu Asp Ser Gly Phe Gly Val His Pro Ala Leu Leu Asp Ala Ala 1125 1130 1135			3408
ctg cac gca acg gct gtc cga gac atg gat gac gca cgc ttg ccg ttc Leu His Ala Thr Ala Val Arg Asp Met Asp Asp Ala Arg Leu Pro Phe 1140 1145 1150			3456
cag tgg gaa ggt gtg tcc ctg cac gcc aag gcc gcg ccg gct ttg cgg Gln Trp Glu Gly Val Ser Leu His Ala Lys Ala Ala Pro Ala Leu Arg 1155 1160 1165			3504
gtc cgc gtg gtc ccg gct ggt gac gat gcc aag tcc ctg ctg gtt tgt Val Arg Val Val Pro Ala Gly Asp Asp Ala Lys Ser Leu Leu Val Cys 1170 1175 1180			3552
gat ggc acc ggt cga ccg gtg atc tcg gtg gac cga ctc gta ttg cgg Asp Gly Thr Gly Arg Pro Val Ile Ser Val Asp Arg Leu Val Leu Arg 1185 1190 1195 1200			3600
tcg gct gcg gcc cgg cgg acc ggt gcg cgc cga cag gcc cat caa gct Ser Ala Ala Ala Arg Arg Thr Gly Ala Arg Arg Gln Ala His Gln Ala 1205 1210 1215			3648
cgg ttg tac cgg ttg agc tgg cca acg gtt caa ctg ccg aca tcc gct Arg Leu Tyr Arg Leu Ser Trp Pro Thr Val Gln Leu Pro Thr Ser Ala 1220 1225 1230			3696
cag cca ccg tcc tgc gtg ctt ctc ggc acc tca gaa gtg tcc gct gac Gln Pro Pro Ser Cys Val Leu Leu Gly Thr Ser Glu Val Ser Ala Asp 1235 1240 1245			3744
ata cag gtg tat ccg gac ctc cgg tcg ttg acg gct gcg ttg gat gcc Ile Gln Val Tyr Pro Asp Leu Arg Ser Leu Thr Ala Ala Leu Asp Ala 1250 1255 1260			3792
ggt gcc gaa cca ccc ggc gtc gtc atc gca ccc acg ccc ccc ggc ggt Gly Ala Glu Pro Pro Gly Val Val Ile Ala Pro Thr Pro Pro Gly Gly 1265 1270 1275 1280			3840
gga cga aca gcg gat gtc cgg gag acg act cgg cat gca ctc gac ctg Gly Arg Thr Ala Asp Val Arg Glu Thr Thr Arg His Ala Leu Asp Leu 1285 1290 1295			3888
gta caa ggc tgg ctt tcc gat cag cga ctc aac gaa tcc cga ttg ctc Val Gln Gly Trp Leu Ser Asp Gln Arg Leu Asn Glu Ser Arg Leu Leu 1300 1305 1310			3936
ctg gtg aca cag gga gca gtg gcc gtg gag ccg ggc gaa ccc gtg acc			3984

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Leu Val Thr Gln Gly Ala Val Ala Val Glu Pro Gly Glu Pro Val Thr	
1315 1320 1325	
gat ctg gcg cag gcc gcg ctc tgg gga ctg ctg cgg tcg acg cag acc	4032
Asp Leu Ala Gln Ala Ala Leu Trp Gly Leu Leu Arg Ser Thr Gln Thr	
1330 1335 1340	
gaa cac cct gat cgc ttc gtc ctc gtc gat gtg cct gag ccc gcg caa	4080
Glu His Pro Asp Arg Phe Val Leu Val Asp Val Pro Glu Pro Ala Gln	
1345 1350 1355 1360	
ctc ctc ccc gcg ctg ccg ggg gtg ctg gcc tgc ggc gaa cct cag ctc	4128
Leu Leu Pro Ala Leu Pro Gly Val Leu Ala Cys Gly Glu Pro Gln Leu	
1365 1370 1375	
gcg ttg cga cgt ggc ggc gct cat gcg ccc aga ctg gct gga ctg ggc	4176
Ala Leu Arg Arg Gly Gly Ala His Ala Pro Arg Leu Ala Gly Leu Gly	
1380 1385 1390	
agc gat gac gtc ctg ccc gtg ccg gac ggc acc ggg tgg cga ttg gag	4224
Ser Asp Asp Val Leu Pro Val Pro Asp Gly Thr Gly Trp Arg Leu Glu	
1395 1400 1405	
gcc acg cgc ccg gga agc ctg gat ggg ttg gca ttg gtg gac gaa ccg	4272
Ala Thr Arg Pro Gly Ser Leu Asp Gly Leu Ala Leu Val Asp Glu Pro	
1410 1415 1420	
acg gcc acg gca ccg ctg ggt gac ggt gag gtc agg att gcg atg cgc	4320
Thr Ala Thr Ala Pro Leu Gly Asp Gly Glu Val Arg Ile Ala Met Arg	
1425 1430 1435 1440	
gcg gcc ggg gtg aac ttc cgg gat gcg ctc atc gcg ctc ggt atg tat	4368
Ala Ala Gly Val Asn Phe Arg Asp Ala Leu Ile Ala Leu Gly Met Tyr	
1445 1450 1455	
ccc ggt gtg gca tcg ctg ggc agt gag ggc gcc ggg gtc gtg gtg gag	4416
Pro Gly Val Ala Ser Leu Gly Ser Glu Gly Ala Gly Val Val Val Glu	
1460 1465 1470	
acc ggc ccc ggc gtc acc ggc ctg gca ccc ggc gac cgc gtg atg gga	4464
Thr Gly Pro Gly Val Thr Gly Leu Ala Pro Gly Asp Arg Val Met Gly	
1475 1480 1485	
atg atc ccg aag gcg ttc ggg ccg ctc gcg gtc gcc gac cat cgc atg	4512
Met Ile Pro Lys Ala Phe Gly Pro Leu Ala Val Ala Asp His Arg Met	
1490 1495 1500	
gtg acg agg att ccc gct ggt tgg agc ttc gcg cgg gcc gca tcg gtg	4560
Val Thr Arg Ile Pro Ala Gly Trp Ser Phe Ala Arg Ala Ala Ser Val	
1505 1510 1515 1520	
ccg atc gtc ttt ctc acc gcc tac tac gcg ctg gtt gat ctc gcc ggg	4608
Pro Ile Val Phe Leu Thr Ala Tyr Tyr Ala Leu Val Asp Leu Ala Gly	
1525 1530 1535	
ttg aga cca ggg gag tcg ttg ctg gtt cat tcg gcc gcc ggt ggg gtg	4656
Leu Arg Pro Gly Glu Ser Leu Leu Val His Ser Ala Ala Gly Gly Val	
1540 1545 1550	
ggg atg gcc gcg atc caa ctc gcc agg cac ctc ggt gca gag gtg tac	4704
Gly Met Ala Ala Ile Gln Leu Ala Arg His Leu Gly Ala Glu Val Tyr	
1555 1560 1565	

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gcc acc gct agc gag gac aag tgg caa gcc gtg gag ctg agc cga gaa	4752
Ala Thr Ala Ser Glu Asp Lys Trp Gln Ala Val Glu Leu Ser Arg Glu	
1570 1575 1580	
cac ctc gct tcg tcg cgg acg tgc gat ttc gag cag cag ttc ctc ggg	4800
His Leu Ala Ser Ser Arg Thr Cys Asp Phe Glu Gln Gln Phe Leu Gly	
1585 1590 1595 1600	
gca acc ggc gga cgc ggc gtc gac gtc gtg ctc aac tcc ctc gcc ggg	4848
Ala Thr Gly Gly Arg Gly Val Asp Val Val Leu Asn Ser Leu Ala Gly	
1605 1610 1615	
gag ttc gcc gat gcg tct ctg cga atg ctg ccg cgc ggt ggc cgt ttc	4896
Glu Phe Ala Asp Ala Ser Leu Arg Met Leu Pro Arg Gly Gly Arg Phe	
1620 1625 1630	
ctg gag ttg ggg aag acg gat gtt cgt gac ccc gtc gag gtc gcc gat	4944
Leu Glu Leu Gly Lys Thr Asp Val Arg Asp Pro Val Glu Val Ala Asp	
1635 1640 1645	
gcg cat ccg ggc gtg tct tac cag gct ttc gat acc gta gag gca ggc	4992
Ala His Pro Gly Val Ser Tyr Gln Ala Phe Asp Thr Val Glu Ala Gly	
1650 1655 1660	
ccg cag cga atc ggc gag atg ctt cac gag ctg gtg gag ttg ttc gag	5040
Pro Gln Arg Ile Gly Glu Met Leu His Glu Leu Val Glu Leu Phe Glu	
1665 1670 1675 1680	
gga cgc gtg ctg gag ccc ctg cct gtc acg gct tgg gac gtt cgg cag	5088
Gly Arg Val Leu Glu Pro Leu Pro Val Thr Ala Trp Asp Val Arg Gln	
1685 1690 1695	
gcg ccc gag gcg cta cgg cac ctg agc caa gcg cgg cat gtg gga aag	5136
Ala Pro Glu Ala Leu Arg His Leu Ser Gln Ala Arg His Val Gly Lys	
1700 1705 1710	
ctg gtg ctc acc atg cct ccg gtg tgg gac gcc gca ggc acg gtt ctg	5184
Leu Val Leu Thr Met Pro Pro Val Trp Asp Ala Ala Gly Thr Val Leu	
1715 1720 1725	
gtt acc ggc gga acg gga gca ctt ggc gca gag gtc gcc cgg cac ctc	5232
Val Thr Gly Gly Thr Gly Ala Leu Gly Ala Glu Val Ala Arg His Leu	
1730 1735 1740	
gtg atc gag cgc ggg gtg cga aac ctg gtc ctc gtc agc agg cgc ggt	5280
Val Ile Glu Arg Gly Val Arg Asn Leu Val Leu Val Ser Arg Arg Gly	
1745 1750 1755 1760	
ccc gca gcc agt ggc gct gct gag ctc gtg gcg caa ctg acg gcc tac	5328
Pro Ala Ala Ser Gly Ala Ala Glu Leu Val Ala Gln Leu Thr Ala Tyr	
1765 1770 1775	
ggt gcc gag gtt tcc ttg cag gct tgc gat gtc gcc gat cgt gag acc	5376
Gly Ala Glu Val Ser Leu Gln Ala Cys Asp Val Ala Asp Arg Glu Thr	
1780 1785 1790	
ttg gcg aag gtg ctt gcc agc atc ccg gac gag cat ccg ttg acc gcc	5424
Leu Ala Lys Val Leu Ala Ser Ile Pro Asp Glu His Pro Leu Thr Ala	
1795 1800 1805	
gtg gtg cac gcg gct ggt gtt ctc gac gac gga gtg tcc gaa tcg ctc	5472
Val Val His Ala Ala Gly Val Leu Asp Asp Gly Val Ser Glu Ser Leu	
1810 1815 1820	

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acc	gtg	gag	cgg	ctg	gac	cag	gtt	ctg	cgc	ccg	aag	gtc	gat	ggc	gcg	5520
Thr	Val	Glu	Arg	Leu	Asp	Gln	Val	Leu	Arg	Pro	Lys	Val	Asp	Gly	Ala	
1825				1830					1835						1840	
cgg	aat	ctg	ctc	gag	ctg	atc	gac	ccg	gac	gtg	gcc	ctc	gtg	ttg	ttc	5568
Arg	Asn	Leu	Leu	Glu	Leu	Ile	Asp	Pro	Asp	Val	Ala	Leu	Val	Leu	Phe	
				1845				1850						1855		
tcg	tcg	gtg	tcg	ggg	gtg	ctc	ggc	agc	ggg	ggg	cag	ggg	aac	tac	gcg	5616
Ser	Ser	Val	Ser	Gly	Val	Leu	Gly	Ser	Gly	Gly	Gln	Gly	Asn	Tyr	Ala	
			1860				1865						1870			
gcg	gcc	aac	tcc	ttc	ctc	gac	gca	ttg	gcg	cag	caa	agg	cag	tcg	cgc	5664
Ala	Ala	Asn	Ser	Phe	Leu	Asp	Ala	Leu	Ala	Gln	Gln	Arg	Gln	Ser	Arg	
		1875				1880						1885				
ggc	cta	ccg	acg	aga	tca	ttg	gcc	tgg	ggg	ccc	tgg	gcg	gaa	cat	ggc	5712
Gly	Leu	Pro	Thr	Arg	Ser	Ala	Ala	Trp	Gly	Pro	Trp	Ala	Glu	His	Gly	
1890					1895					1900						
atg	gcc	agc	acc	ttg	cgc	gaa	gcc	gag	cag	gat	cga	ttg	gcg	cga	tct	5760
Met	Ala	Ser	Thr	Leu	Arg	Glu	Ala	Glu	Gln	Asp	Arg	Leu	Ala	Arg	Ser	
1905				1910						1915					1920	
ggg	ttg	ctg	ccg	atc	tcg	acc	gag	gag	ggg	ttg	tcc	cag	ttc	gac	gcc	5808
Gly	Leu	Leu	Pro	Ile	Ser	Thr	Glu	Glu	Gly	Leu	Ser	Gln	Phe	Asp	Ala	
			1925						1930					1935		
gcg	tgc	ggc	ggc	gcg	cat	acc	gtg	gtg	gcg	ccg	gtt	cga	ttc	agc	cgc	5856
Ala	Cys	Gly	Gly	Ala	His	Thr	Val	Val	Ala	Pro	Val	Arg	Phe	Ser	Arg	
		1940					1945					1950				
ttg	tcc	gac	ggg	aac	gcg	atc	aag	ttc	tcc	gtc	ctg	caa	ggg	ttg	gtc	5904
Leu	Ser	Asp	Gly	Asn	Ala	Ile	Lys	Phe	Ser	Val	Leu	Gln	Gly	Leu	Val	
		1955				1960						1965				
ggg	ccg	cat	cgc	gtc	aac	aaa	gcg	gcg	act	gcg	gat	gat	gcc	gag	agc	5952
Gly	Pro	His	Arg	Val	Asn	Lys	Ala	Ala	Thr	Ala	Asp	Asp	Ala	Glu	Ser	
1970					1975					1980						
ctc	cgg	aaa	cgg	ttg	gga	cgc	ttg	ccg	gat	gca	gaa	caa	cat	cgg	att	6000
Leu	Arg	Lys	Arg	Leu	Gly	Arg	Leu	Pro	Asp	Ala	Glu	Gln	His	Arg	Ile	
1985				1990					1995					2000		
ctg	ctg	gac	ctc	gtc	cgc	atg	cat	gtg	gcg	gca	gtg	ctc	gga	ttc	gcc	6048
Leu	Leu	Asp	Leu	Val	Arg	Met	His	Val	Ala	Ala	Val	Leu	Gly	Phe	Ala	
			2005					2010					2015			
ggg	tct	cag	gag	atc	acc	gcg	gac	ggc	acg	ttc	aag	gtg	ctg	ggc	ttc	6096
Gly	Ser	Gln	Glu	Ile	Thr	Ala	Asp	Gly	Thr	Phe	Lys	Val	Leu	Gly	Phe	
		2020					2025					2030				
gac	tcg	ttg	acc	gtg	gtc	gag	ttg	cgc	aac	cgg	atc	aac	ggg	gcg	acg	6144
Asp	Ser	Leu	Thr	Val	Val	Glu	Leu	Arg	Asn	Arg	Ile	Asn	Gly	Ala	Thr	
		2035				2040					2045					
ggg	ctg	cga	ctg	ccc	gcc	acc	ctg	gtg	ttc	aac	tac	ccg	acg	ccg	gat	6192
Gly	Leu	Arg	Leu	Pro	Ala	Thr	Leu	Val	Phe	Asn	Tyr	Pro	Thr	Pro	Asp	
2050				2055					2060							
gcg	ctc	gcc	gcg	cac	ctc	gtc	acc	gcg	ctg	tcc	gca	gac	cgc	ctg	gcc	6240
Ala	Leu	Ala	Ala	His	Leu	Val	Thr	Ala	Leu	Ser	Ala	Asp	Arg	Leu	Ala	

2065	2070	LeA33955-US 2075	2080	
ggg aca ttc gag gaa ctc gac agg tgg gcg gcg aac ctg ccc acg ctg				6288
Gly Thr Phe Glu Glu Leu Asp Arg Trp Ala Ala Asn Leu Pro Thr Leu	2085	2090	2095	
gcc agg gat gag gcc acg cgg gcg cag atc acc acc cgg cta cag gcg				6336
Ala Arg Asp Glu Ala Thr Arg Ala Gln Ile Thr Thr Arg Leu Gln Ala	2100	2105	2110	
atc ttg cag agc ctg gcg gac gtg tcc ggc gga acc ggc ggc ggc tcc				6384
Ile Leu Gln Ser Leu Ala Asp Val Ser Gly Gly Thr Gly Gly Gly Ser	2115	2120	2125	
gtg ccg gac cgg ctc aga tcg gcc acg gac gac gag ctt ttc caa ctc				6432
Val Pro Asp Arg Leu Arg Ser Ala Thr Asp Asp Glu Leu Phe Gln Leu	2130	2135	2140	
ctc gac aac gat ctc gaa ctt ccc tga				6459
Leu Asp Asn Asp Leu Glu Leu Pro	2145	2150		

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 <211> 2152  
 <212> PRT  
 <213> Saccharopolyspora spinosa

<400> 44  
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 Ser Leu Lys Glu Asn Glu Arg Leu Arg Arg Gly Arg Asp Arg Phe Ser  
 20 25 30  
 Ala Glu Lys Asp Asp Pro Ile Ala Ile Val Ala Met Ser Cys Arg Tyr  
 35 40 45  
 Pro Gly Gln Val Ser Ser Pro Glu Asp Leu Trp Gln Leu Ala Ala Gly  
 50 55 60  
 Gly Val Asp Ala Ile Ser Glu Val Pro Gly Asp Arg Gly Trp Asp Leu  
 65 70 75 80  
 Asp Gly Val Phe Val Pro Asp Ser Asp Arg Pro Gly Thr Ser Tyr Ala  
 85 90 95  
 Cys Ala Gly Gly Phe Leu Gln Gly Val Ser Glu Phe Asp Ala Gly Phe  
 100 105 110  
 Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg  
 115 120 125  
 Leu Leu Leu Glu Val Ala Trp Glu Val Phe Glu Arg Ala Gly Leu Glu  
 130 135 140  
 Gln Arg Ser Thr Arg Gly Ser Arg Val Gly Val Phe Val Gly Thr Asn  
 145 150 155 160  
 Gly Gln Asp Tyr Ala Ser Trp Leu Arg Thr Pro Pro Pro Ala Val Ala  
 165 170 175  
 Gly His Val Leu Thr Gly Gly Ala Ala Ala Val Leu Ser Gly Arg Val



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180					185					190					
Ala	Tyr	Ser	Phe	Gly	Phe	Glu	Gly	Pro	Ala	Val	Thr	Val	Asp	Thr	Ala
		195					200					205			
Cys	Ser	Ser	Ser	Leu	Val	Ala	Leu	His	Leu	Ala	Gly	Gln	Ala	Leu	Arg
	210					215					220				
Ala	Gly	Glu	Cys	Asp	Leu	Ala	Leu	Ala	Gly	Gly	Val	Thr	Val	Met	Ser
225					230					235					240
Thr	Pro	Lys	Val	Phe	Leu	Glu	Phe	Ser	Arg	Gln	Arg	Gly	Leu	Ala	Pro
				245					250					255	
Asp	Gly	Arg	Cys	Lys	Ser	Phe	Ala	Ala	Gly	Ala	Asp	Gly	Thr	Gly	Trp
			260					265					270		
Gly	Glu	Gly	Ala	Gly	Leu	Leu	Leu	Leu	Glu	Arg	Leu	Ser	Asp	Ala	Arg
		275					280					285			
Arg	Asn	Gly	His	Glu	Val	Leu	Ala	Val	Val	Arg	Gly	Ser	Ala	Val	Asn
	290					295					300				
Gln	Asp	Gly	Ala	Ser	Asn	Gly	Leu	Thr	Ala	Pro	Asn	Gly	Ser	Ser	Gln
305					310					315					320
Gln	Arg	Val	Ile	Thr	Gln	Ala	Leu	Ala	Ser	Ala	Gly	Leu	Ser	Val	Ser
				325					330					335	
Asp	Val	Asp	Ala	Val	Glu	Ala	His	Gly	Thr	Gly	Thr	Arg	Leu	Gly	Asp
			340					345					350		
Pro	Ile	Glu	Ala	Gln	Ala	Leu	Ile	Ala	Thr	Tyr	Gly	Arg	Asp	Arg	Asp
		355					360					365			
Pro	Gly	Arg	Pro	Leu	Trp	Leu	Gly	Ser	Val	Lys	Ser	Asn	Ile	Gly	His
	370				375					380					
Thr	Gln	Ala	Ala	Ala	Gly	Val	Ala	Gly	Val	Ile	Lys	Met	Val	Met	Ala
385					390					395					400
Met	Arg	His	Gly	Gln	Leu	Pro	Arg	Thr	Leu	His	Val	Glu	Ser	Pro	Ser
				405					410					415	
Pro	Glu	Val	Asp	Trp	Ser	Ala	Gly	Thr	Val	Gln	Leu	Leu	Thr	Glu	Asn
			420					425					430		
Thr	Pro	Trp	Pro	Arg	Ser	Gly	Arg	Val	Arg	Arg	Val	Gly	Val	Ser	Ser
		435					440					445			
Phe	Gly	Ile	Ser	Gly	Thr	Asn	Ala	His	Val	Ile	Leu	Glu	Gln	Pro	Pro
	450					455					460				
Gly	Val	Pro	Ser	Gln	Ser	Ala	Gly	Pro	Gly	Ser	Gly	Ser	Val	Val	Asp
465					470					475					480
Val	Pro	Val	Val	Pro	Trp	Met	Val	Ser	Gly	Lys	Thr	Pro	Glu	Ala	Leu
				485					490					495	
Ser	Ala	Gln	Ala	Thr	Ala	Leu	Met	Thr	Tyr	Leu	Asp	Glu	Arg	Pro	Asp
			500					505					510		
Val	Ser	Ser	Leu	Asp	Val	Gly	Tyr	Ser	Leu	Ala	Leu	Thr	Arg	Ser	Ala

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515                      520                      525  
 Leu Asp Glu Arg Ala Val Val Leu Gly Ser Asp Arg Glu Thr Leu Leu  
     530                      535                      540  
 Cys Gly Val Lys Ala Leu Ser Ala Gly His Glu Ala Ser Gly Leu Val  
     545                      550                      555                      560  
 Thr Gly Ser Val Gly Ala Gly Gly Arg Ile Gly Phe Val Phe Ser Gly  
                     565                      570                      575  
 Gln Gly Gly Gln Trp Leu Gly Met Gly Arg Gly Leu Tyr Arg Ala Phe  
                     580                      585                      590  
 Pro Val Phe Ala Ala Ala Phe Asp Glu Ala Cys Ala Glu Leu Asp Ala  
                     595                      600                      605  
 His Leu Gly Gln Glu Ile Gly Val Arg Glu Val Val Ser Gly Ser Asp  
     610                      615                      620  
 Ala Gln Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser Gly Leu Phe Ala  
     625                      630                      635                      640  
 Leu Gln Val Gly Leu Leu Lys Leu Leu Asp Ser Trp Gly Val Arg Pro  
                     645                      650                      655  
 Ser Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe Ala  
                     660                      665                      670  
 Ala Gly Val Val Ser Leu Ser Gly Ala Ala Arg Leu Val Ala Gly Arg  
                     675                      680                      685  
 Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Gly Met Leu Ala Val  
     690                      695                      700  
 Pro Ala Gly Glu Glu Leu Leu Trp Ser Leu Leu Ala Asp Gln Gly Asp  
     705                      710                      715                      720  
 Arg Val Gly Ile Ala Ala Val Asn Ala Ala Gly Ser Val Val Leu Ser  
                     725                      730                      735  
 Gly Asp Arg Asp Val Leu Asp Asp Leu Ala Gly Arg Leu Asp Gly Gln  
                     740                      745                      750  
 Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser Tyr  
                     755                      760                      765  
 Arg Met Asp Pro Met Leu Ala Glu Phe Ala Glu Leu Ala Arg Thr Val  
     770                      775                      780  
 Asp Tyr Arg Arg Cys Glu Val Pro Ile Val Ser Thr Leu Thr Gly Asp  
     785                      790                      795                      800  
 Leu Asp Asp Ala Gly Arg Met Ser Gly Pro Asp Tyr Trp Val Arg Gln  
                     805                      810                      815  
 Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Gln Ala Leu Val Glu  
                     820                      825                      830  
 His Asp Val Ala Thr Val Val Glu Leu Gly Pro Asp Gly Ala Leu Ser  
                     835                      840                      845  
 Ala Leu Ile Gln Glu Cys Val Ala Ala Ser Asp His Ala Gly Arg Leu

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860

850 855  
Ser Ala Val Pro Ala Met Arg Arg Asn Gln Asp Glu Ala Gln Lys Val  
865 870 875 880  
Met Thr Ala Leu Ala His Val His Val Arg Gly Gly Ala Val Asp Trp  
885 890 895  
Arg Ser Phe Phe Ala Gly Thr Gly Ala Lys Gln Ile Glu Leu Pro Thr  
900 905 910  
Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Val Pro Ser Asp Ser Gly  
915 920 925  
Asp Val Thr Gly Ala Gly Leu Ala Gly Ala Glu His Pro Leu Leu Gly  
930 935 940  
Ala Val Val Pro Val Ala Gly Gly Asp Glu Val Leu Leu Thr Gly Arg  
945 950 955 960  
Ile Ser Val Arg Thr His Pro Trp Leu Ala Glu His Arg Val Leu Gly  
965 970 975  
Glu Val Ile Val Ala Gly Thr Ala Leu Glu Ile Ala Leu His Ala  
980 985 990  
Gly Glu Arg Leu Gly Cys Glu Arg Val Glu Glu Leu Thr Leu Glu Ala  
995 1000 1005  
Pro Leu Val Leu Pro Glu Arg Gly Ala Ile Gln Val Gln Leu Arg Val  
1010 1015 1020  
Gly Ala Pro Glu Asn Ser Gly Arg Arg Pro Met Ala Leu Tyr Ser Arg  
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Pro Glu Gly Ala Ala Glu His Asp Trp Thr Arg His Ala Thr Gly Arg  
1045 1050 1055  
Leu Ala Pro Gly Arg Gly Glu Ala Ala Gly Asp Leu Ala Asp Trp Pro  
1060 1065 1070  
Ala Pro Gly Ala Leu Pro Val Asp Leu Asp Glu Phe Tyr Arg Asp Leu  
1075 1080 1085  
Ala Glu Leu Gly Leu Glu Tyr Gly Pro Ile Phe Gln Gly Leu Lys Ala  
1090 1095 1100  
Ala Trp Arg Gln Gly Asp Glu Val Tyr Ala Glu Ala Ala Leu Pro Gly  
1105 1110 1115 1120  
Thr Glu Asp Ser Gly Phe Gly Val His Pro Ala Leu Leu Asp Ala Ala  
1125 1130 1135  
Leu His Ala Thr Ala Val Arg Asp Met Asp Asp Ala Arg Leu Pro Phe  
1140 1145 1150  
Gln Trp Glu Gly Val Ser Leu His Ala Lys Ala Ala Pro Ala Leu Arg  
1155 1160 1165  
Val Arg Val Val Pro Ala Gly Asp Asp Ala Lys Ser Leu Leu Val Cys  
1170 1175 1180  
Asp Gly Thr Gly Arg Pro Val Ile Ser Val Asp Arg Leu Val Leu Arg

## LeA33955-US

185                      1190                      1195                      1200  
 Ser Ala Ala Ala Arg Arg Thr Gly Ala Arg Arg Gln Ala His Gln Ala  
                                  1205                      1210                      1215  
 Arg Leu Tyr Arg Leu Ser Trp Pro Thr Val Gln Leu Pro Thr Ser Ala  
                                  1220                      1225                      1230  
 Gln Pro Pro Ser Cys Val Leu Leu Gly Thr Ser Glu Val Ser Ala Asp  
                                  1235                      1240                      1245  
 Ile Gln Val Tyr Pro Asp Leu Arg Ser Leu Thr Ala Ala Leu Asp Ala  
                                  1250                      1255                      1260  
 Gly Ala Glu Pro Pro Gly Val Val Ile Ala Pro Thr Pro Pro Gly Gly  
 265                                   1270                      1275                      1280  
 Gly Arg Thr Ala Asp Val Arg Glu Thr Thr Arg His Ala Leu Asp Leu  
                                  1285                      1290                      1295  
 Val Gln Gly Trp Leu Ser Asp Gln Arg Leu Asn Glu Ser Arg Leu Leu  
                                  1300                      1305                      1310  
 Leu Val Thr Gln Gly Ala Val Ala Val Glu Pro Gly Glu Pro Val Thr  
                                  1315                      1320                      1325  
 Asp Leu Ala Gln Ala Ala Leu Trp Gly Leu Leu Arg Ser Thr Gln Thr  
                                  1330                      1335                      1340  
 Glu His Pro Asp Arg Phe Val Leu Val Asp Val Pro Glu Pro Ala Gln  
 345                                   1350                      1355                      1360  
 Leu Leu Pro Ala Leu Pro Gly Val Leu Ala Cys Gly Glu Pro Gln Leu  
                                  1365                      1370                      1375  
 Ala Leu Arg Arg Gly Gly Ala His Ala Pro Arg Leu Ala Gly Leu Gly  
                                  1380                      1385                      1390  
 Ser Asp Asp Val Leu Pro Val Pro Asp Gly Thr Gly Trp Arg Leu Glu  
                                  1395                      1400                      1405  
 Ala Thr Arg Pro Gly Ser Leu Asp Gly Leu Ala Leu Val Asp Glu Pro  
                                  1410                      1415                      1420  
 Thr Ala Thr Ala Pro Leu Gly Asp Gly Glu Val Arg Ile Ala Met Arg  
 425                                   1430                      1435                      1440  
 Ala Ala Gly Val Asn Phe Arg Asp Ala Leu Ile Ala Leu Gly Met Tyr  
                                  1445                      1450                      1455  
 Pro Gly Val Ala Ser Leu Gly Ser Glu Gly Ala Gly Val Val Val Glu  
                                  1460                      1465                      1470  
 Thr Gly Pro Gly Val Thr Gly Leu Ala Pro Gly Asp Arg Val Met Gly  
                                  1475                      1480                      1485  
 Met Ile Pro Lys Ala Phe Gly Pro Leu Ala Val Ala Asp His Arg Met  
                                  1490                      1495                      1500  
 Val Thr Arg Ile Pro Ala Gly Trp Ser Phe Ala Arg Ala Ala Ser Val  
 505                                   1510                      1515                      1520  
 Pro Ile Val Phe Leu Thr Ala Tyr Tyr Ala Leu Val Asp Leu Ala Gly

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1525 1530 1535  
 Leu Arg Pro Gly Glu Ser Leu Leu Val His Ser Ala Ala Gly Gly Val  
 1540 1545 1550  
 Gly Met Ala Ala Ile Gln Leu Ala Arg His Leu Gly Ala Glu Val Tyr  
 1555 1560 1565  
 Ala Thr Ala Ser Glu Asp Lys Trp Gln Ala Val Glu Leu Ser Arg Glu  
 1570 1575 1580  
 His Leu Ala Ser Ser Arg Thr Cys Asp Phe Glu Gln Gln Phe Leu Gly  
 585 1590 1595 1600  
 Ala Thr Gly Gly Arg Gly Val Asp Val Val Leu Asn Ser Leu Ala Gly  
 1605 1610 1615  
 Glu Phe Ala Asp Ala Ser Leu Arg Met Leu Pro Arg Gly Gly Arg Phe  
 1620 1625 1630  
 Leu Glu Leu Gly Lys Thr Asp Val Arg Asp Pro Val Glu Val Ala Asp  
 1635 1640 1645  
 Ala His Pro Gly Val Ser Tyr Gln Ala Phe Asp Thr Val Glu Ala Gly  
 1650 1655 1660  
 Pro Gln Arg Ile Gly Glu Met Leu His Glu Leu Val Glu Leu Phe Glu  
 665 1670 1675 1680  
 Gly Arg Val Leu Glu Pro Leu Pro Val Thr Ala Trp Asp Val Arg Gln  
 1685 1690 1695  
 Ala Pro Glu Ala Leu Arg His Leu Ser Gln Ala Arg His Val Gly Lys  
 1700 1705 1710  
 Leu Val Leu Thr Met Pro Pro Val Trp Asp Ala Ala Gly Thr Val Leu  
 1715 1720 1725  
 Val Thr Gly Gly Thr Gly Ala Leu Gly Ala Glu Val Ala Arg His Leu  
 1730 1735 1740  
 Val Ile Glu Arg Gly Val Arg Asn Leu Val Leu Val Ser Arg Arg Gly  
 745 1750 1755 1760  
 Pro Ala Ala Ser Gly Ala Ala Glu Leu Val Ala Gln Leu Thr Ala Tyr  
 1765 1770 1775  
 Gly Ala Glu Val Ser Leu Gln Ala Cys Asp Val Ala Asp Arg Glu Thr  
 1780 1785 1790  
 Leu Ala Lys Val Leu Ala Ser Ile Pro Asp Glu His Pro Leu Thr Ala  
 1795 1800 1805  
 Val Val His Ala Ala Gly Val Leu Asp Asp Gly Val Ser Glu Ser Leu  
 1810 1815 1820  
 Thr Val Glu Arg Leu Asp Gln Val Leu Arg Pro Lys Val Asp Gly Ala  
 825 1830 1835 1840  
 Arg Asn Leu Leu Glu Leu Ile Asp Pro Asp Val Ala Leu Val Leu Phe  
 1845 1850 1855  
 Ser Ser Val Ser Gly Val Leu Gly Ser Gly Gly Gln Gly Asn Tyr Ala

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1860 1865 1870  
 Ala Ala Asn Ser Phe Leu Asp Ala Leu Ala Gln Gln Arg Gln Ser Arg  
 1875 1880 1885  
 Gly Leu Pro Thr Arg Ser Leu Ala Trp Gly Pro Trp Ala Glu His Gly  
 1890 1895 1900  
 Met Ala Ser Thr Leu Arg Glu Ala Glu Gln Asp Arg Leu Ala Arg Ser  
 905 1910 1915 1920  
 Gly Leu Leu Pro Ile Ser Thr Glu Glu Gly Leu Ser Gln Phe Asp Ala  
 1925 1930 1935  
 Ala Cys Gly Gly Ala His Thr Val Val Ala Pro Val Arg Phe Ser Arg  
 1940 1945 1950  
 Leu Ser Asp Gly Asn Ala Ile Lys Phe Ser Val Leu Gln Gly Leu Val  
 1955 1960 1965  
 Gly Pro His Arg Val Asn Lys Ala Ala Thr Ala Asp Asp Ala Glu Ser  
 1970 1975 1980  
 Leu Arg Lys Arg Leu Gly Arg Leu Pro Asp Ala Glu Gln His Arg Ile  
 985 1990 1995 2000  
 Leu Leu Asp Leu Val Arg Met His Val Ala Ala Val Leu Gly Phe Ala  
 2005 2010 2015  
 Gly Ser Gln Glu Ile Thr Ala Asp Gly Thr Phe Lys Val Leu Gly Phe  
 2020 2025 2030  
 Asp Ser Leu Thr Val Val Glu Leu Arg Asn Arg Ile Asn Gly Ala Thr  
 2035 2040 2045  
 Gly Leu Arg Leu Pro Ala Thr Leu Val Phe Asn Tyr Pro Thr Pro Asp  
 2050 2055 2060  
 Ala Leu Ala Ala His Leu Val Thr Ala Leu Ser Ala Asp Arg Leu Ala  
 065 2070 2075 2080  
 Gly Thr Phe Glu Glu Leu Asp Arg Trp Ala Ala Asn Leu Pro Thr Leu  
 2085 2090 2095  
 Ala Arg Asp Glu Ala Thr Arg Ala Gln Ile Thr Thr Arg Leu Gln Ala  
 2100 2105 2110  
 Ile Leu Gln Ser Leu Ala Asp Val Ser Gly Gly Thr Gly Gly Gly Ser  
 2115 2120 2125  
 Val Pro Asp Arg Leu Arg Ser Ala Thr Asp Asp Glu Leu Phe Gln Leu  
 2130 2135 2140  
 Leu Asp Asn Asp Leu Glu Leu Pro  
 145 2150

&lt;210&gt; 45

&lt;211&gt; 9513

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

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&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(9510)

&lt;223&gt; ORF20; polyketide synthase

&lt;400&gt; 45

atg	tcg	aat	gaa	gag	aag	ctc	cgg	gag	tac	ttg	cgg	cgt	gcg	ctc	gtg	48
Met	Ser	Asn	Glu	Glu	Lys	Leu	Arg	Glu	Tyr	Leu	Arg	Arg	Ala	Leu	Val	
1				5					10					15		
gat	ctg	cac	cag	gcg	cgc	gag	cgg	ctg	cac	gag	gcg	gag	tcg	gga	gag	96
Asp	Leu	His	Gln	Ala	Arg	Glu	Arg	Leu	His	Glu	Ala	Glu	Ser	Gly	Glu	
			20					25					30			
cgg	gaa	ccc	atc	gcg	atc	gtg	gcg	atg	ggc	tgc	cgg	tac	ccg	ggt	ggg	144
Arg	Glu	Pro	Ile	Ala	Ile	Val	Ala	Met	Gly	Cys	Arg	Tyr	Pro	Gly	Gly	
		35					40					45				
gtg	cag	gac	ccg	gaa	ggg	ctg	tgg	aaa	ctg	gtc	gcc	tcc	ggt	ggc	gac	192
Val	Gln	Asp	Pro	Glu	Gly	Leu	Trp	Lys	Leu	Val	Ala	Ser	Gly	Gly	Asp	
	50					55					60					
gcc	atc	ggt	gaa	ttc	ccc	gct	gat	cgt	ggt	tgg	cac	ctc	gac	gag	ctc	240
Ala	Ile	Gly	Glu	Phe	Pro	Ala	Asp	Arg	Gly	Trp	His	Leu	Asp	Glu	Leu	
65					70				75						80	
tac	gat	ccc	gac	ccg	gat	cag	ccc	gga	acc	tgc	tac	acc	cgg	cac	ggc	288
Tyr	Asp	Pro	Asp	Pro	Asp	Gln	Pro	Gly	Thr	Cys	Tyr	Thr	Arg	His	Gly	
				85					90					95		
ggc	ttc	ctc	cac	gac	gcc	ggc	gag	ttc	gac	gcg	gga	ttc	ttc	gac	atc	336
Gly	Phe	Leu	His	Asp	Ala	Gly	Glu	Phe	Asp	Ala	Gly	Phe	Phe	Asp	Ile	
			100					105					110			
agc	ccc	cgt	gag	gcg	ctc	gcg	atg	gac	ccg	cag	cag	cgg	ctg	ctg	ctg	384
Ser	Pro	Arg	Glu	Ala	Leu	Ala	Met	Asp	Pro	Gln	Gln	Arg	Leu	Leu	Leu	
		115					120					125				
gaa	atc	tcc	tgg	gag	acc	gtc	gaa	tcc	gct	ggg	atg	gac	ccg	agg	tcc	432
Glu	Ile	Ser	Trp	Glu	Thr	Val	Glu	Ser	Ala	Gly	Met	Asp	Pro	Arg	Ser	
	130					135					140					
ttg	cgg	ggg	agc	cgc	acc	ggg	gtg	ttc	gcg	gga	ttg	atg	tac	gag	ggc	480
Leu	Arg	Gly	Ser	Arg	Thr	Gly	Val	Phe	Ala	Gly	Leu	Met	Tyr	Glu	Gly	
145					150					155					160	
tat	gac	acc	ggc	gcc	cac	cgg	gca	gga	gaa	ggt	gtc	gaa	ggc	tat	ctc	528
Tyr	Asp	Thr	Gly	Ala	His	Arg	Ala	Gly	Glu	Gly	Val	Glu	Gly	Tyr	Leu	
				165					170					175		
gga	acc	ggc	aat	gcg	gga	agc	gtc	gcc	tct	ggt	cgg	gtt	gcg	tat	gcg	576
Gly	Thr	Gly	Asn	Ala	Gly	Ser	Val	Ala	Ser	Gly	Arg	Val	Ala	Tyr	Ala	
			180					185					190			
ttc	ggg	ttc	gag	ggc	cca	gcg	gtg	acg	gta	gac	acg	gcg	tgc	tcg	tcg	624
Phe	Gly	Phe	Glu	Gly	Pro	Ala	Val	Thr	Val	Asp	Thr	Ala	Cys	Ser	Ser	
		195					200					205				
tcg	ttg	gtg	gcg	ctg	cat	ttg	gcg	tgt	cag	tcg	ttg	cgg	cag	ggc	gag	672
Ser	Leu	Val	Ala	Leu	His	Leu	Ala	Cys	Gln	Ser	Leu	Arg	Gln	Gly	Glu	
	210					215					220					
tgt	gat	ctg	gcg	ctg	gcc	ggt	gga	gtg	acg	gtg	atg	tcg	acg	ccg	gag	720

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Cys 225	Asp	Leu	Ala	Leu	Ala 230	Gly	Gly	Val	Thr	Val 235	Met	Ser	Thr	Pro	Glu 240
agg Arg	ttc Phe	gtg Val	gag Glu	ttc Phe 245	tcc Ser	cgt Arg	cag Gln	cgt Arg	ggg Gly 250	ctc Leu	gca Ala	ccg Pro	gat Asp	ggg Gly 255	cgg Arg
768															
tgt Cys	aag Lys	tcg Ser	ttc Phe 260	gcg Ala	gcg Ala	gct Ala	gcg Ala	gat Asp 265	gga Gly	acc Thr	ggg Gly	tgg Trp	ggg Gly 270	gag Glu	ggg Gly
816															
gcc Ala	ggg Gly	ttg Leu 275	gtg Val	ttg Leu	ctg Leu	gag Glu	cgg Arg 280	ctg Leu	tca Ser	gac Asp	gcc Ala	agg Arg 285	cgg Arg	aac Asn	ggg Gly
864															
cat His	cgg Arg 290	gta Val	ctg Leu	gcg Ala	gtt Val	gtt Val 295	cgt Arg	ggg Gly	agc Ser	gcg Ala	gtg Val 300	aat Asn	cag Gln	gac Asp	ggg Gly
912															
gcg Ala 305	tcg Ser	aac Asn	gga Gly	ttg Leu	acg Thr 310	gcc Ala	ccg Pro	aac Asn	ggg Gly	ctg Leu 315	gcc Ala	cag Gln	gag Glu	cgg Arg	gtc Val 320
960															
att Ile	cag Gln	cag Gln	gtg Val	ctc Leu 325	acg Thr	agt Ser	gcg Ala	ggg Gly	ctg Leu 330	tcg Ser	gcg Ala	tcc Ser	gat Asp	gtg Val 335	gac Asp
1008															
gct Ala	gtg Val	gag Glu	gcg Ala 340	cat His	gga Gly	acg Thr	ggg Gly	acg Thr 345	cgg Arg	ctt Leu	ggg Gly	gat Asp	ccg Pro 350	atc Ile	gag Glu
1056															
gcg Ala	cag Gln	gct Ala 355	ctg Leu	ata Ile	gcc Ala	gcc Ala	tat Tyr 360	gga Gly	cag Gln	gat Asp	cgg Arg	gac Asp 365	cgg Arg	gac Asp	cgg Arg
1104															
ccg Pro	ctg Leu 370	tgg Trp	ttg Leu	ggg Gly	tcg Ser	gtc Val 375	aag Lys	tcc Ser	aac Asn	atc Ile	ggg Gly 380	cat His	acg Thr	cag Gln	gcg Ala
1152															
gct Ala 385	gcg Ala	ggc Gly	gtc Val	gct Ala	ggg Gly 390	gtg Val	atc Ile	aag Lys	atg Met	gtc Val 395	atg Met	gcg Ala	atg Met	cgg Arg	cac His 400
1200															
ggg Gly	gag Glu	ctg Leu	ccg Pro	cgc Arg 405	acg Thr	ttg Leu	cac His	gtg Val	gac Asp 410	gag Glu	ccg Pro	aat Asn	tcg Ser	cac His 415	gtg Val
1248															
gac Asp	tgg Trp	tcg Ser	gct Ala 420	ggg Gly	gcg Ala	gtc Val	cga Arg	ctc Leu 425	ctg Leu	acc Thr	gag Glu	aac Asn	atc Ile 430	cgc Arg	tgg Trp
1296															
cca Pro	ggg Gly	acg Thr 435	ggg Gly	acg Thr	cgc Arg	cgc Arg	gct Ala 440	gga Gly	gtg Val	tcg Ser	tcg Ser	ttc Phe 445	ggg Gly	gta Val	agc Ser
1344															
ggg Gly 450	acc Thr	aac Asn	gca Ala	cac His	gtc Val	atc Ile 455	ctc Leu	gaa Glu	cac His	gac Asp	ccg Pro 460	ctc Leu	gcc Ala	gtg Val	acc Thr
1392															
gag Glu 465	aac Asn	gag Glu	gaa Glu	gca Ala	gcg Ala 470	cag Gln	tcc Ser	cca Pro	gca Ala	cct Pro 475	ggg Gly	atc Ile	gtg Val	ccc Pro	tgg Trp 480
1440															



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gcg	ttg	tcc	ggg	cgg	tcg	tcg	acg	gcg	ctg	cgg	gcc	cag	gcc	gaa	cgg	1488
Ala	Leu	Ser	Gly	Arg	Ser	Ser	Thr	Ala	Leu	Arg	Ala	Gln	Ala	Glu	Arg	
				485					490					495		
ctg	cgc	gag	ctg	tgc	gag	cag	acc	gat	ccc	gac	ccc	gtc	gat	gtc	ggc	1536
Leu	Arg	Glu	Leu	Cys	Glu	Gln	Thr	Asp	Pro	Asp	Pro	Val	Asp	Val	Gly	
			500					505					510			
ttc	tca	ctg	gcc	gcc	acg	cgc	acg	gct	tgg	gag	cac	cga	gcg	gtg	gtg	1584
Phe	Ser	Leu	Ala	Ala	Thr	Arg	Thr	Ala	Trp	Glu	His	Arg	Ala	Val	Val	
		515					520					525				
ctt	ggc	cgg	gac	agc	gct	acg	ttg	cgc	tcc	ggg	ctt	ggc	gtt	gtt	gcc	1632
Leu	Gly	Arg	Asp	Ser	Ala	Thr	Leu	Arg	Ser	Gly	Leu	Gly	Val	Val	Ala	
	530					535					540					
agc	ggc	gaa	cca	gcg	gtc	gat	gtc	gtt	gag	ggg	agc	gtc	ctg	gac	ggc	1680
Ser	Gly	Glu	Pro	Ala	Val	Asp	Val	Val	Glu	Gly	Ser	Val	Leu	Asp	Gly	
545				550					555						560	
gag	gtc	gtc	ttc	gtc	ttc	ccc	ggc	cag	ggc	tgg	cag	tgg	gcc	ggc	atg	1728
Glu	Val	Val	Phe	Val	Phe	Pro	Gly	Gln	Gly	Trp	Gln	Trp	Ala	Gly	Met	
			565				570							575		
gca	gtc	gac	ctg	ctg	gac	gct	tcg	ccg	acg	ttc	gcg	cgc	cac	atg	gac	1776
Ala	Val	Asp	Leu	Leu	Asp	Ala	Ser	Pro	Thr	Phe	Ala	Arg	His	Met	Asp	
			580					585					590			
gag	tgc	gcc	acc	gcg	ctg	cgg	agg	tac	gtg	gac	tgg	tcg	ttg	gtc	gac	1824
Glu	Cys	Ala	Thr	Ala	Leu	Arg	Arg	Tyr	Val	Asp	Trp	Ser	Leu	Val	Asp	
		595					600					605				
gtg	ctg	cgc	gga	gcg	gag	aac	tcc	cca	ccg	ctg	gac	cgg	gtg	gac	gtg	1872
Val	Leu	Arg	Gly	Ala	Glu	Asn	Ser	Pro	Pro	Leu	Asp	Arg	Val	Asp	Val	
	610					615					620					
ctc	cag	ccc	gcg	tcc	ttc	gcg	gtg	atg	gtg	tcg	ctc	gcc	gag	gtg	tgg	1920
Leu	Gln	Pro	Ala	Ser	Phe	Ala	Val	Met	Val	Ser	Leu	Ala	Glu	Val	Trp	
					630					635					640	
cgt	tcc	tac	ggg	gtg	agg	ccg	gcg	gcc	gtc	gtc	ggc	cac	agt	caa	ggc	1968
Arg	Ser	Tyr	Gly	Val	Arg	Pro	Ala	Ala	Val	Val	Gly	His	Ser	Gln	Gly	
			645					650					655			
gaa	atc	gcc	gcg	gcc	tgc	gca	gcc	ggg	gtg	ctg	ccg	ctg	gag	gat	gcg	2016
Glu	Ile	Ala	Ala	Ala	Cys	Ala	Ala	Gly	Val	Leu	Pro	Leu	Glu	Asp	Ala	
			660					665					670			
gcc	agg	ctt	gtc	gca	ttg	cgc	agc	aga	gcg	ttg	aag	gga	ctt	tcg	ggg	2064
Ala	Arg	Leu	Val	Ala	Leu	Arg	Ser	Arg	Ala	Leu	Lys	Gly	Leu	Ser	Gly	
		675					680					685				
cgg	ggc	ggc	atg	gcg	tcg	ctg	gcc	tgc	cct	gcg	gat	gag	gtc	gcg	gca	2112
Arg	Gly	Gly	Met	Ala	Ser	Leu	Ala	Cys	Pro	Ala	Asp	Glu	Val	Ala	Ala	
	690					695					700					
ttg	ttc	gcg	gga	tcg	ggc	ggc	cgt	ctg	gaa	gtt	gcg	gcg	atc	aac	ggc	2160
Leu	Phe	Ala	Gly	Ser	Gly	Gly	Arg	Leu	Glu	Val	Ala	Ala	Ile	Asn	Gly	
	705				710					715					720	
ccg	cga	tcg	gtc	gtg	gtg	tcc	ggc	gat	ctg	gaa	gcg	gtg	gac	gaa	ctg	2208
Pro	Arg	Ser	Val	Val	Val	Ser	Gly	Asp	Leu	Glu	Ala	Val	Asp	Glu	Leu	
				725					730					735		

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ctg	gca	gag	tgc	gct	gaa	aag	gac	atg	cgt	gca	cgc	cgt	atc	ccc	gtc	2256
Leu	Ala	Glu	Cys	Ala	Glu	Lys	Asp	Met	Arg	Ala	Arg	Arg	Ile	Pro	Val	
			740					745					750			
gac	tac	gcc	tcg	cat	tca	gcg	cac	gtg	gag	gtg	gtt	cgg	agc	ccg	gtg	2304
Asp	Tyr	Ala	Ser	His	Ser	Ala	His	Val	Glu	Val	Val	Arg	Ser	Pro	Val	
		755					760					765				
ctg	gcg	gcc	gcc	gcc	ggg	gtg	cga	cac	cgg	gac	ggc	cag	gtg	ccg	tgg	2352
Leu	Ala	Ala	Ala	Ala	Gly	Val	Arg	His	Arg	Asp	Gly	Gln	Val	Pro	Trp	
	770					775					780					
tgg	tcg	acg	gtg	atc	ggc	gac	tgg	gtg	gat	ccg	gcc	agg	ctg	gac	ggc	2400
Trp	Ser	Thr	Val	Ile	Gly	Asp	Trp	Val	Asp	Pro	Ala	Arg	Leu	Asp	Gly	
	785				790					795					800	
gag	tat	tgg	tat	cgg	aac	ctc	cgg	cag	ccg	gtc	cgg	ttc	gaa	cac	gcc	2448
Glu	Tyr	Trp	Tyr	Arg	Asn	Leu	Arg	Gln	Pro	Val	Arg	Phe	Glu	His	Ala	
				805					810					815		
gtg	cag	ggc	ctg	gtc	gag	cgg	gga	ttc	ggc	ctg	ttc	atc	gaa	atg	agt	2496
Val	Gln	Gly	Leu	Val	Glu	Arg	Gly	Phe	Gly	Leu	Phe	Ile	Glu	Met	Ser	
			820					825					830			
gcg	cat	ccg	gtg	ctg	acc	acg	gcg	gtc	gag	gaa	acc	ggc	gcg	gag	tcg	2544
Ala	His	Pro	Val	Leu	Thr	Thr	Ala	Val	Glu	Glu	Thr	Gly	Ala	Glu	Ser	
		835					840					845				
gag	acc	gcc	gtg	gcc	gcg	gta	ggc	acc	ttg	cga	cgt	gac	tcg	ggc	ggc	2592
Glu	Thr	Ala	Val	Ala	Ala	Val	Gly	Thr	Leu	Arg	Arg	Asp	Ser	Gly	Gly	
	850					855					860					
ctc	cgg	agg	ttg	ttg	cat	tcg	ctg	gcc	gag	gcg	tac	gtg	cgc	ggc	gcc	2640
Leu	Arg	Arg	Leu	Leu	His	Ser	Leu	Ala	Glu	Ala	Tyr	Val	Arg	Gly	Ala	
					870					875					880	
acc	gtg	gac	tgg	gcc	gtg	gcg	ttc	ggg	ggc	gcg	ggc	cga	cgg	ctg	gac	2688
Thr	Val	Asp	Trp	Ala	Val	Ala	Phe	Gly	Gly	Ala	Gly	Arg	Arg	Leu	Asp	
				885					890					895		
ctg	ccg	acc	tac	ccg	ttc	cag	cgc	cag	cgg	tac	tgg	ctg	gac	aag	gga	2736
Leu	Pro	Thr	Tyr	Pro	Phe	Gln	Arg	Gln	Arg	Tyr	Trp	Leu	Asp	Lys	Gly	
			900					905					910			
gct	gcc	tcc	gac	gag	gct	cgt	gcg	gtc	tcg	gac	ccg	gcg	gcg	ggc	tgg	2784
Ala	Ala	Ser	Asp	Glu	Ala	Arg	Ala	Val	Ser	Asp	Pro	Ala	Ala	Gly	Trp	
		915					920					925				
ttc	tgg	caa	gcc	gtg	gcg	cgc	caa	gac	ctg	aaa	agc	gtg	tcc	gat	gcc	2832
Phe	Trp	Gln	Ala	Val	Ala	Arg	Gln	Asp	Leu	Lys	Ser	Val	Ser	Asp	Ala	
	930					935					940					
ctc	gat	ctc	gac	gcc	gac	gca	ccg	ctg	agc	gca	aca	ctt	cca	gcc	ctg	2880
Leu	Asp	Leu	Asp	Ala	Asp	Ala	Pro	Leu	Ser	Ala	Thr	Leu	Pro	Ala	Leu	
	945				950					955					960	
tcc	gtc	tgg	cac	cgt	cag	gaa	cga	gaa	agg	gtc	ttg	gca	gac	ggc	tgg	2928
Ser	Val	Trp	His	Arg	Gln	Glu	Arg	Glu	Arg	Val	Leu	Ala	Asp	Gly	Trp	
				965					970					975		
cgg	tac	cga	gtc	gac	tgg	gta	cgg	gtg	gcc	ccg	cag	ccg	gtc	cgg	aga	2976
Arg	Tyr	Arg	Val	Asp	Trp	Val	Arg	Val	Ala	Pro	Gln	Pro	Val	Arg	Arg	

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980					985					990						
acg	cgg	gaa	acc	tgg	ctc	ctg	gtc	gtt	ccc	ccg	ggc	ggc	atc	gag	gaa	3024
Thr	Arg	Glu	Thr	Trp	Leu	Leu	Val	Val	Pro	Pro	Gly	Gly	Ile	Glu	Glu	
		995					1000					1005				
gcg	ctg	gtc	gaa	cgg	ctg	acg	gat	gcg	ttg	aac	acg	cga	ggg	atc	agc	3072
Ala	Leu	Val	Glu	Arg	Leu	Thr	Asp	Ala	Leu	Asn	Thr	Arg	Gly	Ile	Ser	
	1010					1015					1020					
acc	ctg	cgc	ctc	gac	gtg	cca	ccg	gcg	gcg	acc	agt	ggc	gaa	ctc	gca	3120
Thr	Leu	Arg	Leu	Asp	Val	Pro	Pro	Ala	Ala	Thr	Ser	Gly	Glu	Leu	Ala	
	1025				1030					1035					1040	
acc	gaa	ctc	cgc	gcc	gca	gcc	gac	ggt	gac	ccg	gtg	aag	gca	atc	ctg	3168
Thr	Glu	Leu	Arg	Ala	Ala	Ala	Asp	Gly	Asp	Pro	Val	Lys	Ala	Ile	Leu	
				1045					1050					1055		
tcg	ctc	acc	gcg	ttg	gac	gag	cga	ccc	cac	ccc	gaa	tgc	aag	gac	gtc	3216
Ser	Leu	Thr	Ala	Leu	Asp	Glu	Arg	Pro	His	Pro	Glu	Cys	Lys	Asp	Val	
			1060					1065					1070			
ccg	agc	ggg	att	gcc	ttg	ctg	ctg	aac	ctg	gtc	aag	gcg	ctc	ggt	gaa	3264
Pro	Ser	Gly	Ile	Ala	Leu	Leu	Leu	Asn	Leu	Val	Lys	Ala	Leu	Gly	Glu	
		1075					1080					1085				
gcc	gac	ctc	aga	att	cct	ctg	tgg	acc	atc	acg	cgt	ggt	gcg	gtc	aag	3312
Ala	Asp	Leu	Arg	Ile	Pro	Leu	Trp	Thr	Ile	Thr	Arg	Gly	Ala	Val	Lys	
	1090					1095					1100					
gca	ggc	ccc	gca	gat	cgg	ctg	ctg	cgc	ccg	atg	cag	gcg	caa	gca	tgg	3360
Ala	Gly	Pro	Ala	Asp	Arg	Leu	Leu	Arg	Pro	Met	Gln	Ala	Gln	Ala	Trp	
	1105				1110					1115					1120	
ggt	ctg	ggg	cga	gta	gcc	gca	ctc	gaa	cac	ccc	gag	cgc	tgg	ggt	ggg	3408
Gly	Leu	Gly	Arg	Val	Ala	Ala	Leu	Glu	His	Pro	Glu	Arg	Trp	Gly	Gly	
				1125					1130					1135		
ctg	atc	gac	ctg	ccg	gat	tcg	ctg	gac	ggc	gac	gtc	ctc	acg	agg	ctg	3456
Leu	Ile	Asp	Leu	Pro	Asp	Ser	Leu	Asp	Gly	Asp	Val	Leu	Thr	Arg	Leu	
			1140					1145					1150			
ggc	gaa	gcg	ctc	acc	aac	ggc	ttg	gcg	gaa	gac	caa	ctg	gcg	att	cgc	3504
Gly	Glu	Ala	Leu	Thr	Asn	Gly	Leu	Ala	Glu	Asp	Gln	Leu	Ala	Ile	Arg	
		1155					1160					1165				
cag	tcg	ggc	gtg	ctg	gcc	cgg	cga	ctg	gta	ccc	gcc	ccg	gcg	aat	cag	3552
Gln	Ser	Gly	Val	Leu	Ala	Arg	Arg	Leu	Val	Pro	Ala	Pro	Ala	Asn	Gln	
	1170					1175					1180					
ccc	gct	gga	cgt	aag	tgg	cgc	ccc	cga	ggg	agc	gcg	ctg	atc	acg	ggc	3600
Pro	Ala	Gly	Arg	Lys	Trp	Arg	Pro	Arg	Gly	Ser	Ala	Leu	Ile	Thr	Gly	
	1185				1190					1195					1200	
gga	ctc	ggc	gcg	gtg	ggc	gca	cag	gtg	gcg	agg	tgg	ttg	gcc	gaa	atc	3648
Gly	Leu	Gly	Ala	Val	Gly	Ala	Gln	Val	Ala	Arg	Trp	Leu	Ala	Glu	Ile	
				1205					1210					1215		
gga	gcc	gag	cga	atc	gtg	ctc	acc	agt	cga	cgg	ggc	aac	caa	gca	gca	3696
Gly	Ala	Glu	Arg	Ile	Val	Leu	Thr	Ser	Arg	Arg	Gly	Asn	Gln	Ala	Ala	
			1220					1225					1230			
ggc	gcc	gcc	gag	ctg	gaa	gcc	gaa	ctc	cgg	gcc	ctt	gga	gcg	caa	gtg	3744

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Gly	Ala	Ala	Glu	Leu	Glu	Ala	Glu	Leu	Arg	Ala	Leu	Gly	Ala	Gln	Val		
	1235						1240					1245					
tcc	atc	gtg	gct	tgc	gac	gtg	acc	gat	cgt	gcc	gag	atg	tcc	gca	cta	3792	
Ser	Ile	Val	Ala	Cys	Asp	Val	Thr	Asp	Arg	Ala	Glu	Met	Ser	Ala	Leu		
	1250					1255					1260						
ctg	gcc	gag	ttc	gac	gtc	acc	gcg	gtg	ttc	cac	gcg	gcc	gga	gtc	ggc	3840	
Leu	Ala	Glu	Phe	Asp	Val	Thr	Ala	Val	Phe	His	Ala	Ala	Gly	Val	Gly		
	1265				1270					1275					1280		
cgg	ctg	ctg	ccg	ttg	gcg	gag	acc	gac	cag	aac	ggc	ctg	gcc	gaa	ata	3888	
Arg	Leu	Leu	Pro	Leu	Ala	Glu	Thr	Asp	Gln	Asn	Gly	Leu	Ala	Glu	Ile		
				1285					1290					1295			
tgc	gcg	gcg	aag	gtc	cgc	ggc	gct	cag	gtg	ctg	gac	gaa	ctg	tgc	gac	3936	
Cys	Ala	Ala	Lys	Val	Arg	Gly	Ala	Gln	Val	Leu	Asp	Glu	Leu	Cys	Asp		
			1300					1305					1310				
agc	acc	gat	ctc	gat	gcc	ttc	gtc	ctg	ttc	tcc	tcg	ggc	gcc	ggg	gta	3984	
Ser	Thr	Asp	Leu	Asp	Ala	Phe	Val	Leu	Phe	Ser	Ser	Gly	Ala	Gly	Val		
		1315					1320					1325					
tgg	ggc	ggg	ggc	ggc	cag	ggc	gct	tac	ggc	gcg	gcg	aac	gca	ttc	ttg	4032	
Trp	Gly	Gly	Gly	Gly	Gln	Gly	Ala	Tyr	Gly	Ala	Ala	Asn	Ala	Phe	Leu		
	1330					1335					1340						
gac	aca	ctc	gcc	gaa	caa	cgc	cga	gca	cgc	ggc	ctg	ccg	gca	acc	tcg	4080	
Asp	Thr	Leu	Ala	Glu	Gln	Arg	Arg	Ala	Arg	Gly	Leu	Pro	Ala	Thr	Ser		
	1345				1350					1355					1360		
atc	tcc	tgg	ggc	agt	tgg	gcc	ggc	ggc	ggc	atg	gcc	gac	ggc	gcg	gcg	4128	
Ile	Ser	Trp	Gly	Ser	Trp	Ala	Gly	Gly	Gly	Met	Ala	Asp	Gly	Ala	Ala		
				1365					1370					1375			
ggc	gaa	cac	ctg	cgg	cga	cgc	ggg	ata	cgt	ccg	atg	ccg	gcg	gcg	tcg	4176	
Gly	Glu	His	Leu	Arg	Arg	Arg	Gly	Ile	Arg	Pro	Met	Pro	Ala	Ala	Ser		
			1380					1385					1390				
gcc	atc	ctg	gct	ctg	cag	gaa	gta	ctt	gac	cag	gat	gag	acg	tgc	gtg	4224	
Ala	Ile	Leu	Ala	Leu	Gln	Glu	Val	Leu	Asp	Gln	Asp	Glu	Thr	Cys	Val		
		1395					1400					1405					
tcg	atc	gct	gat	gtg	gac	tgg	gac	cga	ttc	gtt	ccc	acg	ttc	gcc	gcg	4272	
Ser	Ile	Ala	Asp	Val	Asp	Trp	Asp	Arg	Phe	Val	Pro	Thr	Phe	Ala	Ala		
	1410					1415					1420						
act	cgc	gcc	acc	cgg	ttg	ttc	gac	gaa	gtg	ccg	gcg	gcg	aga	aag	gcg	4320	
Thr	Arg	Ala	Thr	Arg	Leu	Phe	Asp	Glu	Val	Pro	Ala	Ala	Arg	Lys	Ala		
	1425				1430					1435					1440		
atg	ccc	gcg	aat	ggg	ccg	gca	gaa	cca	ggc	ggc	tcg	ccg	ttc	gcc	cgc	4368	
Met	Pro	Ala	Asn	Gly	Pro	Ala	Glu	Pro	Gly	Gly	Ser	Pro	Phe	Ala	Arg		
				1445					1450					1455			
aat	ctc	gcg	gag	ctg	ccg	gaa	gcc	caa	cga	cgc	cac	gaa	ctg	gtg	gat	4416	
Asn	Leu	Ala	Glu	Leu	Pro	Glu	Ala	Gln	Arg	Arg	His	Glu	Leu	Val	Asp		
			1460				1465						1470				
ctg	gtg	tgc	gcc	cag	gtg	gca	acc	gtg	ctc	ggg	cac	ggc	agt	cgc	gag	4464	
Leu	Val	Cys	Ala	Gln	Val	Ala	Thr	Val	Leu	Gly	His	Gly	Ser	Arg	Glu		
	1475						1480					1485					

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gaa gtc cag ccc gag cgg gcg ttc cgc gcg ctc ggg ttc gac tcc ctc	4512
Glu Val Gln Pro Glu Arg Ala Phe Arg Ala Leu Gly Phe Asp Ser Leu	
1490 1495 1500	
atg gcg gtg gat ctg cgc aat cgt ttg acc acc gcc acc ggg ttg cgc	4560
Met Ala Val Asp Leu Arg Asn Arg Leu Thr Thr Ala Thr Gly Leu Arg	
1505 1510 1515 1520	
ctg ccg acc aca acc gtc ttc gac tac ccg aat ccg gcc gcc ttg gcc	4608
Leu Pro Thr Thr Thr Val Phe Asp Tyr Pro Asn Pro Ala Ala Leu Ala	
1525 1530 1535	
gct cac ctg ctc gag gag ctg gtg ggt gat gtc gcg tcg gct gcg gtg	4656
Ala His Leu Leu Glu Glu Leu Val Gly Asp Val Ala Ser Ala Ala Val	
1540 1545 1550	
acc gct gcc agc gcg ccc gcg agt gac gaa ccg atc gcg atc gtc gcg	4704
Thr Ala Ala Ser Ala Pro Ala Ser Asp Glu Pro Ile Ala Ile Val Ala	
1555 1560 1565	
atg agc tgc cgg ttt ccg ggt ggc gcg cac tcg ccg gaa gac ctg tgg	4752
Met Ser Cys Arg Phe Pro Gly Gly Ala His Ser Pro Glu Asp Leu Trp	
1570 1575 1580	
cgg ctg gtc gcc gcc ggc acg gag gtg atc ggc gag ttc ccc tcc gac	4800
Arg Leu Val Ala Ala Gly Thr Glu Val Ile Gly Glu Phe Pro Ser Asp	
1585 1590 1595 1600	
cgg ggc tgg gat gcg gaa ggc ctt tac gat ccg gat gct tcc agg cct	4848
Arg Gly Trp Asp Ala Glu Gly Leu Tyr Asp Pro Asp Ala Ser Arg Pro	
1605 1610 1615	
gga acg acg tat gcg cgg atg gcg gga ttc ctc tac gac gcc ggt gag	4896
Gly Thr Thr Tyr Ala Arg Met Ala Gly Phe Leu Tyr Asp Ala Gly Glu	
1620 1625 1630	
ttc gat gcc gac ctg ttc ggc atc agc cca cgt gag gcg ttg gcg atg	4944
Phe Asp Ala Asp Leu Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met	
1635 1640 1645	
gat ccg cag cag cgg ttg gtg ctc gaa atc gcc tgg gaa gcc ctc gaa	4992
Asp Pro Gln Gln Arg Leu Val Leu Glu Ile Ala Trp Glu Ala Leu Glu	
1650 1655 1660	
cgg gcc gga atc gat ccg ttg tcc ttg aag ggc agt ggg gtc ggc acg	5040
Arg Ala Gly Ile Asp Pro Leu Ser Leu Lys Gly Ser Gly Val Gly Thr	
1665 1670 1675 1680	
tac atc ggc gct gga agc cgt ggg tac gcg acg gat gtg cgg cag ttt	5088
Tyr Ile Gly Ala Gly Ser Arg Gly Tyr Ala Thr Asp Val Arg Gln Phe	
1685 1690 1695	
ccc gag gag gcg gag ggc tac ctg ctg acg ggt acc tcg gcc agt gtg	5136
Pro Glu Glu Ala Glu Gly Tyr Leu Leu Thr Gly Thr Ser Ala Ser Val	
1700 1705 1710	
ctg tcg ggt cgg gtc gcg tat tcg ttt ggt ttc gag ggt cct gcg gtg	5184
Leu Ser Gly Arg Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val	
1715 1720 1725	
acg gtg gat acg gct tgt tcg tcg tcg ttg gtg gcg ttg cat ctg gcg	5232
Thr Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala	
1730 1735 1740	

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tgc cag tcg ttg cgt tcg ggc gag tgt gat ctg gcg ttg gcc ggt ggt Cys Gln Ser Leu Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly 1745 1750 1755 1760	5280
gtg acc gtg atg tcg acg ccg gag atg ttc gtg gag ttc tcc cgt cag Val Thr Val Met Ser Thr Pro Glu Met Phe Val Glu Phe Ser Arg Gln 1765 1770 1775	5328
cgc ggt ttg gcg ccg gat ggg cgg tgc aag tcg ttc gcg gag agc gcg Arg Gly Leu Ala Pro Asp Gly Arg Cys Lys Ser Phe Ala Glu Ser Ala 1780 1785 1790	5376
gac ggc acc ggc tgg ggc gaa ggc gcg ggc ctg ttg ttg ctg gag cgg Asp Gly Thr Gly Trp Gly Glu Gly Ala Gly Leu Leu Leu Leu Glu Arg 1795 1800 1805	5424
ttg tcg gac gcc cac cgg aat ggg cat cgg gtg ttg gcg gtg gtt cgt Leu Ser Asp Ala His Arg Asn Gly His Arg Val Leu Ala Val Val Arg 1810 1815 1820	5472
ggg tca gcg gtg aat cag gac ggc gcc tcg aac gga ctg gcg gcg ccg Gly Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Ala Ala Pro 1825 1830 1835 1840	5520
aac ggt ccg tcg cag cag cgg gtg atc aac cag gca ctc gcg aat gcg Asn Gly Pro Ser Gln Gln Arg Val Ile Asn Gln Ala Leu Ala Asn Ala 1845 1850 1855	5568
gct ctt tcg gcg tcc gat gtg gat gcg gtg gag gca cat ggc acc ggg Ala Leu Ser Ala Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly 1860 1865 1870	5616
acc agg ctg ggt gat ccg atc gag gcg cag gca ttg atc gca acg tat Thr Arg Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr 1875 1880 1885	5664
ggg cag gcc ccg gag cgg gat cgg ccc ttg tgg ctg ggg tcg gtc aag Gly Gln Ala Arg Glu Arg Asp Arg Pro Leu Trp Leu Gly Ser Val Lys 1890 1895 1900	5712
tcg aac atc ggt cat acg cag gcc gcg gcg ggt gtt gcc ggt gtg atc Ser Asn Ile Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile 1905 1910 1915 1920	5760
aag atg gtg atg gcc atg cgg cac ggg cag ctg ccc gcc tcg ctg cac Lys Met Val Met Ala Met Arg His Gly Gln Leu Pro Ala Ser Leu His 1925 1930 1935	5808
gcg gat gag ccc acg tcg gag gtc gat tgg tcg tcg ggg gcg gtc cgg Ala Asp Glu Pro Thr Ser Glu Val Asp Trp Ser Ser Gly Ala Val Arg 1940 1945 1950	5856
ctc ctc gcc gaa cag gta cct tgg ccg gag tct gac cgt gtt cgt cgg Leu Leu Ala Glu Gln Val Pro Trp Pro Glu Ser Asp Arg Val Arg Arg 1955 1960 1965	5904
gtg ggg gtt tcg tcg ttc ggg atc agc ggc acc aac gca cat gtg atc Val Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile 1970 1975 1980	5952
ctc gaa caa gct acg aat gcg cca gat agt aca gcg gag acg gac aaa Leu Glu Gln Ala Thr Asn Ala Pro Asp Ser Thr Ala Glu Thr Asp Lys 1985 1990 1995	6000

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1985	1990							1995							2000		
aca gaa tcc gga tct act gtc gat att ccg gtc gtt ccc tgg ttg gtg	Thr Glu Ser Gly Ser Thr Val Asp Ile Pro Val Val Pro Trp Leu Val							2005 2010 2015									
tcg gga aag acg acg gat tcc ctg cgg gga caa gcc gaa cga gtc ttg	Ser Gly Lys Thr Thr Asp Ser Leu Arg Gly Gln Ala Glu Arg Val Leu							2020 2025 2030									
tct cag gtc gag tcc cgg ccg gag cag cgt tcg ctg gat gtt gcc tac	Ser Gln Val Glu Ser Arg Pro Glu Gln Arg Ser Leu Asp Val Ala Tyr							2035 2040 2045									
tcg ctt gct tct ggc cga gcc gcg ctg gat gaa cgc gct gtc gtg ctg	Ser Leu Ala Ser Gly Arg Ala Ala Leu Asp Glu Arg Ala Val Val Leu							2050 2055 2060									
ggt gcg gac cgc ggt gag ctg gtt gct gga ctg gcg gcg ttg gcc gcc	Gly Ala Asp Arg Gly Glu Leu Val Ala Gly Leu Ala Ala Leu Ala Ala							2065 2070 2075 2080									
ggt cag gag gct tct ggg gtg atc agc gga act cgt gct tct gct cgg	Gly Gln Glu Ala Ser Gly Val Ile Ser Gly Thr Arg Ala Ser Ala Arg							2085 2090 2095									
ttc ggg ttc gtg ttc tcg ggg cag ggt ggt cag tgg ttg ggg atg ggc	Phe Gly Phe Val Phe Ser Gly Gln Gly Gly Gln Trp Leu Gly Met Gly							2100 2105 2110									
aga gcg ctc tac tcg aag ttt ccg gtg ttc gct gct gcg ttt gat gag	Arg Ala Leu Tyr Ser Lys Phe Pro Val Phe Ala Ala Ala Phe Asp Glu							2115 2120 2125									
gct tgc gcc gag ttg gag gca cat ctg ggg gaa gac cgc cgg gtt cgg	Ala Cys Ala Glu Leu Glu Ala His Leu Gly Glu Asp Arg Arg Val Arg							2130 2135 2140									
gat gtg gtc ttc ggt tcc gat gcg cag ctg ctg gat cag acg ctg tgg	Asp Val Val Phe Gly Ser Asp Ala Gln Leu Leu Asp Gln Thr Leu Trp							2145 2150 2155 2160									
gcg cag tcg ggt ctg ttc gcg ctg caa gcc ggc ctc ttg ggg ctg ctg	Ala Gln Ser Gly Leu Phe Ala Leu Gln Ala Gly Leu Leu Gly Leu Leu							2165 2170 2175									
ggt tcg tgg ggc gtt cgg ccg gat gtg gtg atg ggg cat tcg gtc ggg	Gly Ser Trp Gly Val Arg Pro Asp Val Val Met Gly His Val Gly							2180 2185 2190									
gag ttg gcc gcc gcg ttt gcg gct ggc gtg ttg tcg ttg cgg gat gcg	Glu Leu Ala Ala Ala Phe Ala Ala Gly Val Leu Ser Leu Arg Asp Ala							2195 2200 2205									
gct cgg ttg gtg gcc gcg cgc gcc cgg ttg atg caa gcc ctg ccc tct	Ala Arg Leu Val Ala Ala Arg Ala Arg Leu Met Gln Ala Leu Pro Ser							2210 2215 2220									
gac ggc gcg atg ttg gcg gtg gct gct ggt gaa gac ctt gtt cgg cca	Asp Gly Ala Met Leu Ala Val Ala Ala Gly Glu Asp Leu Val Arg Pro							2225 2230 2235 2240									
ttg ctg gcc ggt cgg gag gag tcc gtg agc gtc gcc gcg ctc aat gcc																	

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Leu	Leu	Ala	Gly	Arg	Glu	Glu	Ser	Val	Ser	Val	Ala	Ala	Leu	Asn	Ala		
			2245						2250					2255			
ccc	ggt	tcg	gtg	gtg	ttg	tcg	ggc	gat	cgg	gag	gtg	ctg	gcc	agc	atc	6816	
Pro	Gly	Ser	Val	Val	Leu	Ser	Gly	Asp	Arg	Glu	Val	Leu	Ala	Ser	Ile		
		2260					2265					2270					
gtc	ggc	cgg	ctg	acc	gag	ctc	cga	gtc	cgg	acg	cgg	cgc	ttg	cgg	gtc	6864	
Val	Gly	Arg	Leu	Thr	Glu	Leu	Arg	Val	Arg	Thr	Arg	Arg	Leu	Arg	Val		
	2275					2280					2285						
tcc	cat	gct	ttt	cat	tcg	cac	cgg	atg	gac	ccg	atg	ttg	ggc	gag	ttc	6912	
Ser	His	Ala	Phe	His	Ser	His	Arg	Met	Asp	Pro	Met	Leu	Gly	Glu	Phe		
	2290				2295				2300								
gcc	cag	atc	gcc	gag	tct	gcg	gag	ttc	ggt	aag	cca	acg	aca	ccg	ctt	6960	
Ala	Gln	Ile	Ala	Glu	Ser	Ala	Glu	Phe	Gly	Lys	Pro	Thr	Thr	Pro	Leu		
2305				2310					2315					2320			
gtg	tcg	acg	ttg	acg	ggt	gag	ctc	gac	aga	gcc	gcg	gaa	atg	agc	aca	7008	
Val	Ser	Thr	Leu	Thr	Gly	Glu	Leu	Asp	Arg	Ala	Ala	Glu	Met	Ser	Thr		
			2325					2330					2335				
cca	ggg	tat	tgg	gtg	cgc	cag	gcg	cgt	gaa	ccc	gtc	cgt	ttc	gcc	gac	7056	
Pro	Gly	Tyr	Trp	Val	Arg	Gln	Ala	Arg	Glu	Pro	Val	Arg	Phe	Ala	Asp		
	2340					2345					2350						
ggt	gtc	cag	gcc	ctg	gca	gcg	cag	ggc	ata	ggc	acg	gtc	gtc	gag	ctc	7104	
Gly	Val	Gln	Ala	Leu	Ala	Ala	Gln	Gly	Ile	Gly	Thr	Val	Val	Glu	Leu		
	2355				2360						2365						
ggc	ccg	gac	gga	acg	ctg	gcg	gca	ctg	gtt	cgg	gag	tgt	gcg	acc	gag	7152	
Gly	Pro	Asp	Gly	Thr	Leu	Ala	Ala	Leu	Val	Arg	Glu	Cys	Ala	Thr	Glu		
	2370				2375					2380							
tcc	gat	cgg	gtt	ggg	cgg	att	tcg	tcg	atc	cca	ctg	atg	cgc	agg	gag	7200	
Ser	Asp	Arg	Val	Gly	Arg	Ile	Ser	Ser	Ile	Pro	Leu	Met	Arg	Arg	Glu		
2385				2390					2395					2400			
cgg	gac	gag	acc	cgt	tcg	gtg	atg	aca	gcc	ctg	gcg	cat	ctc	cac	acc	7248	
Arg	Asp	Glu	Thr	Arg	Ser	Val	Met	Thr	Ala	Leu	Ala	His	Leu	His	Thr		
			2405					2410					2415				
cgt	ggt	ggt	gag	gtg	gac	tgg	cag	gcg	ttt	ttc	gcc	ggt	acc	ggc	gct	7296	
Arg	Gly	Gly	Glu	Val	Asp	Trp	Gln	Ala	Phe	Phe	Ala	Gly	Thr	Gly	Ala		
		2420					2425					2430					
agg	cag	ctc	gag	ttg	cca	acg	tat	gcc	ttc	caa	cga	cag	cac	tac	tgg	7344	
Arg	Gln	Leu	Glu	Leu	Pro	Thr	Tyr	Ala	Phe	Gln	Arg	Gln	His	Tyr	Trp		
	2435				2440					2445							
atc	gag	tcc	agt	gcg	cgg	cca	gca	gcg	gac	cgc	gca	gac	atc	ggc	gag	7392	
Ile	Glu	Ser	Ser	Ala	Arg	Pro	Ala	Arg	Asp	Arg	Ala	Asp	Ile	Gly	Glu		
	2450				2455				2460								
gtg	gcg	gaa	cag	ttc	tgg	acc	gcg	gtt	gac	caa	ggc	gat	ctg	gca	acg	7440	
Val	Ala	Glu	Gln	Phe	Trp	Thr	Ala	Val	Asp	Gln	Gly	Asp	Leu	Ala	Thr		
2465				2470					2475				2480				
ttg	gtc	gcc	gct	ctg	gat	ctt	ggg	gcg	gac	gac	gac	aca	tgc	gca	tcg	7488	
Leu	Val	Ala	Ala	Leu	Asp	Leu	Gly	Ala	Asp	Asp	Asp	Thr	Cys	Ala	Ser		
			2485				2490						2495				



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ttg agc gat gta ttg ccg gcg ttg tcc tcc tgg cga agc gga ctc cgc	7536
Leu Ser Asp Val Leu Pro Ala Leu Ser Ser Trp Arg Ser Gly Leu Arg	
2500 2505 2510	
aac cgt tcg ctc gtc gat tcc tgc cgg tac cga atc agt tgg cat tcc	7584
Asn Arg Ser Leu Val Asp Ser Cys Arg Tyr Arg Ile Ser Trp His Ser	
2515 2520 2525	
tct cgg gag gtg ccg gcc ccg aag att tcc ggt acc tgg ctg ttg gtc	7632
Ser Arg Glu Val Pro Ala Pro Lys Ile Ser Gly Thr Trp Leu Leu Val	
2530 2535 2540	
gtg ccc ggt gct gcg gat gac gga ttg gtc acg gct ttg acg agt tca	7680
Val Pro Gly Ala Ala Asp Asp Gly Leu Val Thr Ala Leu Thr Ser Ser	
2545 2550 2555 2560	
ctg gtc gga ggc ggc gcc gag gtc gtc cgg atc ggc ctg tcc gaa gag	7728
Leu Val Gly Gly Gly Ala Glu Val Val Arg Ile Gly Leu Ser Glu Glu	
2565 2570 2575	
gac ccg cac cgc gag gac gtc gca cag cgg ctg gcc aat gcg ctg acg	7776
Asp Pro His Arg Glu Asp Val Ala Gln Arg Leu Ala Asn Ala Leu Thr	
2580 2585 2590	
gat gcc ggt caa ctc ggt ggc gtg ctt tcg ctg ttg ggg ctc gat gaa	7824
Asp Ala Gly Gln Leu Gly Gly Val Leu Ser Leu Leu Gly Leu Asp Glu	
2595 2600 2605	
tcg cct gct ccg gga ttc tcc tgc ttg cca act ggt ttc gcg ctg act	7872
Ser Pro Ala Pro Gly Phe Ser Cys Leu Pro Thr Gly Phe Ala Leu Thr	
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Ala	Arg	Leu	Val	Ala	Leu	Arg	Ser	Arg	Ala	Leu	Lys	Gly	Leu	Ser	Gly		
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Leu	Phe	Ala	Gly	Ser	Gly	Gly	Arg	Leu	Glu	Val	Ala	Ala	Ile	Asn	Gly		
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Pro	Arg	Ser	Val	Val	Val	Ser	Gly	Asp	Leu	Glu	Ala	Val	Asp	Glu	Leu		

## 735

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1730

1735

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Page 170

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 Asp Arg Ile Glu Gln Gln Leu Ser Met Leu Thr Gly Glu Ala Arg Ala  
 105                      3110                      3115                      3120  
 Arg Asp Arg Ile Ala Thr Arg Leu Arg Ala Leu His Glu Lys Trp Asn  
 3125                      3130                      3135  
 Ser Ala Ala Glu Val Pro Thr Gly Ala Asp Val Leu Ser Thr Leu Asp  
 3140                      3145                      3150  
 Ser Ala Thr His Asp Glu Ile Phe Glu Phe Ile Asp Asn Glu Leu Asp  
 3155                      3160                      3165  
 Leu Ser  
 3170

&lt;210&gt; 47

&lt;211&gt; 14775

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(14772)

&lt;223&gt; ORF21; polyketide synthase

&lt;400&gt; 47

atg gcc aat gaa gaa aag ctc ttc ggc tat ctg aag aag gta act gcg	48
Met Ala Asn Glu Glu Lys Leu Phe Gly Tyr Leu Lys Lys Val Thr Ala	
1                      5                      10                      15	
gac ctg cat cag acc cgg cag cgc ctg ctc gcg gcc gag agc cgg agt	96
Asp Leu His Gln Thr Arg Gln Arg Leu Leu Ala Ala Glu Ser Arg Ser	
20                      25                      30	
cag gag ccg atc gcg atc gtc tcg gcg agc tgc cga ctg ccc ggc ggc	144
Gln Glu Pro Ile Ala Ile Val Ser Ala Ser Cys Arg Leu Pro Gly Gly	
35                      40                      45	
gtc gac tct ccc gaa gcg ctc tgg caa ctc gtg cgc act ggc acc gac	192
Val Asp Ser Pro Glu Ala Leu Trp Gln Leu Val Arg Thr Gly Thr Asp	
50                      55                      60	
gcc atc tcg gag ttc ccc gcc gac cgg ggc tgg gat ctc ggc cgg ttg	240
Ala Ile Ser Glu Phe Pro Ala Asp Arg Gly Trp Asp Leu Gly Arg Leu	
65                      70                      75                      80	
tac gat ccc gac ccg aac cac cag gga acg tcg tac acg cgg gcc ggc	288
Tyr Asp Pro Asp Pro Asn His Gln Gly Thr Ser Tyr Thr Arg Ala Gly	
85                      90                      95	
ggc ttc ctc gca gga gcg ggc gat ttc gac ccc gcc atg ttc ggc att	336
Gly Phe Leu Ala Gly Ala Gly Asp Phe Asp Pro Ala Met Phe Gly Ile	
100                      105                      110	
tcg ccg cgt gag gcg ttg gcg atg gac ccg cag caa cgg ttg ttg ctg	384
Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu	

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115			120			125												
gag	ctg	tcc	tgg	gag	gcc	ctc	gaa	cgg	gcg	ggc	ata	gac	ccg	aca	tcc			432
Glu	Leu	Ser	Trp	Glu	Ala	Leu	Glu	Arg	Ala	Gly	Ile	Asp	Pro	Thr	Ser			
	130					135					140							
ctg	cgc	ggc	agc	aag	acc	ggg	gtc	ttc	ggg	ggg	gtc	acg	ccc	cag	gag			480
Leu	Arg	Gly	Ser	Lys	Thr	Gly	Val	Phe	Gly	Gly	Val	Thr	Pro	Gln	Glu			
145					150				155						160			
tac	ggg	ccg	tcc	ttg	cag	gag	atg	agc	cga	aac	gct	ggg	ggg	ttt	gga			528
Tyr	Gly	Pro	Ser	Leu	Gln	Glu	Met	Ser	Arg	Asn	Ala	Gly	Gly	Phe	Gly			
				165					170					175				
ctc	acc	ggg	cgg	atg	gtg	agt	gtg	gcg	tcg	ggg	cgg	gtt	gcg	tat	tcg			576
Leu	Thr	Gly	Arg	Met	Val	Ser	Val	Ala	Ser	Gly	Arg	Val	Ala	Tyr	Ser			
			180					185					190					
ttt	ggg	ttt	gag	ggg	cct	gcg	gtg	acg	gtg	gat	acg	gcg	tgt	tcg	tcg			624
Phe	Gly	Phe	Glu	Gly	Pro	Ala	Val	Thr	Val	Asp	Thr	Ala	Cys	Ser	Ser			
		195					200					205						
tcg	ttg	gtg	gcc	ctg	cat	ttg	gcg	tgt	cag	tcg	ttg	cgt	tcc	ggc	gaa			672
Ser	Leu	Val	Ala	Leu	His	Leu	Ala	Cys	Gln	Ser	Leu	Arg	Ser	Gly	Glu			
	210					215					220							
tgc	gat	ctc	gcg	ctg	gcc	ggc	ggg	gtg	acg	gtg	atg	gcg	aca	ccg	gcg			720
Cys	Asp	Leu	Ala	Leu	Ala	Gly	Gly	Val	Thr	Val	Met	Ala	Thr	Pro	Ala			
225					230					235					240			
acg	ttc	gtg	gag	ttc	tcc	cgt	cag	cgt	ggg	ttg	gct	ccg	gac	ggg	cgg			768
Thr	Phe	Val	Glu	Phe	Ser	Arg	Gln	Arg	Gly	Leu	Ala	Pro	Asp	Gly	Arg			
				245					250					255				
tgc	aag	tcg	ttc	gcg	gct	gcc	gcg	gat	ggc	acc	ggg	tgg	ggg	gag	ggg			816
Cys	Lys	Ser	Phe	Ala	Ala	Ala	Ala	Asp	Gly	Thr	Gly	Trp	Gly	Glu	Gly			
			260					265					270					
gcc	ggg	ctg	gtg	ttg	ctg	gag	cgg	ttg	tcg	gat	gcg	cgg	cgg	aat	ggg			864
Ala	Gly	Leu	Val	Leu	Leu	Glu	Arg	Leu	Ser	Asp	Ala	Arg	Arg	Asn	Gly			
		275				280						285						
cac	gag	gtt	ctg	gcg	gtg	gtg	cgg	ggg	agc	gcg	gtg	aac	cag	gac	ggc			912
His	Glu	Val	Leu	Ala	Val	Val	Arg	Gly	Ser	Ala	Val	Asn	Gln	Asp	Gly			
	290					295					300							
gcg	tcg	aat	ggg	ttg	act	gcg	ccg	aat	ggg	ccg	tcg	cag	cag	cgg	gtg			960
Ala	Ser	Asn	Gly	Leu	Thr	Ala	Pro	Asn	Gly	Pro	Ser	Gln	Gln	Arg	Val			
305					310					315					320			
atc	acc	cag	gcg	ttg	gcg	agt	gcg	ggg	ctg	tcg	gtt	tcc	gat	gtg	gat			1008
Ile	Thr	Gln	Ala	Leu	Ala	Ser	Ala	Gly	Leu	Ser	Val	Ser	Asp	Val	Asp			
				325					330					335				
gcg	gtc	gag	gca	cat	ggg	acc	ggg	acc	acg	ttg	ggg	gat	ccg	atc	gag			1056
Ala	Val	Glu	Ala	His	Gly	Thr	Gly	Thr	Thr	Leu	Gly	Asp	Pro	Ile	Glu			
			340				345						350					
gca	cag	gcc	ctg	atc	gcc	acg	tac	ggg	cag	ggc	cgg	gag	aag	gat	cgg			1104
Ala	Gln	Ala	Leu	Ile	Ala	Thr	Tyr	Gly	Gln	Gly	Arg	Glu	Lys	Asp	Arg			
		355					360					365						
ccg	ttg	tgg	ttg	ggg	tcg	gtc	aag	tcc	aac	atc	ggg	cac	acg	cag	gcg			1152

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Pro	Leu	Trp	Leu	Gly	Ser	Val	Lys	Ser	Asn	Ile	Gly	His	Thr	Gln	Ala
370						375					380				
gcc	gct	ggc	gtt	gcc	ggc	gtc	atc	aag	atg	gtc	ttg	gcg	atg	cgg	cac
Ala	Ala	Gly	Val	Ala	Gly	Val	Ile	Lys	Met	Val	Leu	Ala	Met	Arg	His
385					390					395					400
ggg	cag	ctg	ccc	gcc	acg	ttg	cat	gtg	gat	gag	ccc	acg	tcg	gcg	gtg
Gly	Gln	Leu	Pro	Ala	Thr	Leu	His	Val	Asp	Glu	Pro	Thr	Ser	Ala	Val
				405					410					415	
gac	tgg	tcg	gcg	ggt	tcg	gtc	cgg	ctt	ctc	acg	gag	aac	acg	ccc	tgg
Asp	Trp	Ser	Ala	Gly	Ser	Val	Arg	Leu	Leu	Thr	Glu	Asn	Thr	Pro	Trp
			420				425					430			
ccg	gac	agt	ggt	cgt	cct	tgc	cgg	gtg	ggg	gtg	tcg	tcg	ttc	ggg	atc
Pro	Asp	Ser	Gly	Arg	Pro	Cys	Arg	Val	Gly	Val	Ser	Ser	Phe	Gly	Ile
		435					440					445			
agc	ggc	acc	aac	gca	cat	gtg	att	ctc	gaa	cag	tct	cca	gtc	gag	cag
Ser	Gly	Thr	Asn	Ala	His	Val	Ile	Leu	Glu	Gln	Ser	Pro	Val	Glu	Gln
	450					455					460				
ggc	gaa	ccg	gcc	ggg	ccg	gtc	gaa	ggc	gag	cgg	gaa	ccg	gat	gta	gcc
Gly	Glu	Pro	Ala	Gly	Pro	Val	Glu	Gly	Glu	Arg	Glu	Pro	Asp	Val	Ala
465					470				475						480
gtc	ccc	gtg	gtg	cct	tgg	gtg	ctg	tcg	ggt	aag	aca	ccg	gag	gct	gcg
Val	Pro	Val	Val	Pro	Trp	Val	Leu	Ser	Gly	Lys	Thr	Pro	Glu	Ala	Ala
				485					490					495	
cgg	gcg	cag	gcc	gaa	cgg	gtg	cat	tcg	cat	atc	gag	gac	cgg	ccg	ggg
Arg	Ala	Gln	Ala	Glu	Arg	Val	His	Ser	His	Ile	Glu	Asp	Arg	Pro	Gly
			500					505					510		
ctg	tcg	ccg	gtg	gat	gtg	gcg	tat	tcg	cta	gga	atg	aca	cgc	gcg	gcg
Leu	Ser	Pro	Val	Asp	Val	Ala	Tyr	Ser	Leu	Gly	Met	Thr	Arg	Ala	Ala
		515					520					525			
ctg	gat	gaa	cgc	gca	gtg	gtg	ttg	ggc	tcg	gac	cgt	gcc	gcg	ctc	ctg
Leu	Asp	Glu	Arg	Ala	Val	Val	Leu	Gly	Ser	Asp	Arg	Ala	Ala	Leu	Leu
	530					535					540				
acc	ggg	ttg	agg	gca	ttc	gcc	gac	ggc	tgc	gat	gcg	ccc	gaa	gtg	gtt
Thr	Gly	Leu	Arg	Ala	Phe	Ala	Asp	Gly	Cys	Asp	Ala	Pro	Glu	Val	Val
545					550					555					560
tcg	ggg	tct	gtg	ggg	ctt	ggt	ggc	cgc	gtc	ggg	ttc	gtg	ttc	tcg	ggt
Ser	Gly	Ser	Val	Gly	Leu	Gly	Gly	Arg	Val	Gly	Phe	Val	Phe	Ser	Gly
				565					570					575	
cag	ggt	ggt	cag	tgg	ccg	ggg	atg	ggc	cgg	ggg	ctc	tac	tcg	gtg	ttt
Gln	Gly	Gly	Gln	Trp	Pro	Gly	Met	Gly	Arg	Gly	Leu	Tyr	Ser	Val	Phe
			580					585					590		
ccg	gtg	ttc	gcc	gac	gcg	ttc	gac	gag	gct	tgc	gcg	gag	ttg	gat	gca
Pro	Val	Phe	Ala	Asp	Ala	Phe	Asp	Glu	Ala	Cys	Ala	Glu	Leu	Asp	Ala
		595					600					605			
cac	ctg	ggc	cag	gaa	ctg	cgg	gtt	cgg	gat	gtg	gtg	ttc	ggt	tcg	caa
His	Leu	Gly	Gln	Glu	Leu	Arg	Val	Arg	Asp	Val	Val	Phe	Gly	Ser	Gln
	610					615					620				

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gcg Ala 625	tgg Trp	ttg Leu	ctg Leu	gat Asp	cgg Arg 630	acg Thr	gtg Val	tgg Trp	gcg Ala	cag Gln 635	tcg Ser	ggt Gly	ttg Leu	ttc Phe	gcg Ala 640	1920
ttg Leu	cag Gln	att Ile	ggc Gly 645	ttg Leu	ctg Leu	cgg Arg	ctg Leu	ctg Leu	ggt Gly 650	tcg Ser	tgg Trp	ggt Gly	gtt Val	cgg Arg 655	ccg Pro	1968
gat Asp	gtg Val	gtg Val	ttg Leu 660	ggg Gly	cac His	tcg Ser	gtg Val	ggt Gly 665	gag Glu	ctg Leu	gct Ala	gcg Ala	gtg Val 670	cat His	gcg Ala	2016
gct Ala	ggt Gly	gtg Val 675	ttg Leu	tcg Ser	ttg Leu	tcg Ser	gag Glu 680	gcc Ala	gcg Ala	cgg Arg	ttg Leu	gtg Val 685	gcg Ala	ggt Gly	cgc Arg	2064
gcc Ala 690	cgg Arg	ttg Leu	atg Met	cag Gln	gcg Ala	ttg Leu 695	cct Pro	tct Ser	ggt Gly	ggt Gly	gcc Ala 700	atg Met	ctc Leu	gcg Ala	gtc Val	2112
gct Ala 705	acg Thr	ggt Gly	gag Glu	ttt Phe	cag Gln 710	gtc Val	gat Asp	cct Pro	ctg Leu	ctg Leu 715	gat Asp	ggg Gly	gtg Val	cgg Arg	gac Asp 720	2160
cgg Arg	atc Ile	ggt Gly	atc Ile	gcg Ala 725	gcg Ala	gtg Val	aat Asn	ggc Gly	ccg Pro 730	gaa Glu	tcg Ser	gtt Val	gtg Val	ctc Leu 735	tct Ser	2208
ggt Gly	gac Asp	cgc Arg	gag Glu 740	ctg Leu	ctc Leu	acc Thr	gag Glu	atc Ile 745	gct Ala	gat Asp	cgg Arg	ttg Leu	cac His 750	gat Asp	cag Gln	2256
ggg Gly	tgc Cys	cgg Arg 755	acc Thr	cgg Arg	tgg Trp	ttg Leu	cgg Arg 760	gtg Val	tcg Ser	cat His	gct Ala	ttc Phe 765	cat His	tcg Ser	ccc Pro	2304
cat His 770	atg Met	gag Glu	ccg Pro	atg Met	ctg Leu	gag Glu 775	gag Glu	ttc Phe	gcc Ala	cag Gln	atc Ile 780	tcc Ser	cga Arg	ggc Gly	cgc Arg	2352
gaa Glu 785	tat Tyr	cac His	gca Ala	ccg Pro	gaa Glu 790	ctg Leu	ccg Pro	atc Ile	atc Ile	tcg Ser 795	acc Thr	ctg Leu	atc Ile	ggt Gly	gag Glu 800	2400
ctg Leu	gac Asp	ggt Gly	ggt Gly	cga Arg 805	gtg Val	atg Met	ggc Gly	act Thr	ccc Pro 810	gag Glu	tac Tyr	tgg Trp	gtg Val	cgt Arg 815	cag Gln	2448
gtg Val	cgt Arg	gag Glu	ccc Pro 820	gtc Val	cgt Arg	ttc Phe	gcc Ala	gag Glu 825	ggt Gly	gtc Val	cag Gln	gcg Ala	ctt Leu 830	gtc Val	ggt Gly	2496
cag Gln	ggt Gly	gtc Val 835	ggc Gly	acg Thr	att Ile	gtc Val	gaa Glu 840	ttg Leu	ggt Gly	ccg Pro	gac Asp	ggg Gly 845	gcg Ala	ttg Leu	tcg Ser	2544
acg Thr 850	ttg Leu	gtc Val	gag Glu	gag Glu	tgt Cys	gtg Val 855	gcg Ala	gaa Glu	tcc Ser	ggg Gly	cgg Arg 860	gtg Val	gcc Ala	ggg Gly	atc Ile	2592
ccg Pro 865	ctg Leu	atg Met	cgc Arg	aag Lys	gac Asp 870	cgc Arg	gac Asp	gag Glu	gcg Ala	cga Arg 875	acc Thr	gtg Val	ctg Leu	gca Ala	gct Ala 880	2640



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ttg gcg cag atc cac acc cgt ggt ggt gag gtg gac tgg cgg tcg ttt	2688
Leu Ala Gln Ile His Thr Arg Gly Gly Glu Val Asp Trp Arg Ser Phe	
885 890 895	
ttc gcc ggt acc ggg gcg aag caa gtc gac ctg ccc acc tac gcc ttc	2736
Phe Ala Gly Thr Gly Ala Lys Gln Val Asp Leu Pro Thr Tyr Ala Phe	
900 905 910	
cag cgg cag cgg tac tgg ctg gca tcc acc ggg cgt gcg ggt gac gtg	2784
Gln Arg Gln Arg Tyr Trp Leu Ala Ser Thr Gly Arg Ala Gly Asp Val	
915 920 925	
acc gcc gcc gga ttg gcc gag gcg gac cat ccg ctg ctc ggt gcg gtg	2832
Thr Ala Ala Gly Leu Ala Glu Ala Asp His Pro Leu Leu Gly Ala Val	
930 935 940	
gtt gcg ttg gca gac ggc gaa ggt gtg gtg ctg acc ggt cgg ttg aca	2880
Val Ala Leu Ala Asp Gly Glu Gly Val Val Leu Thr Gly Arg Leu Thr	
945 950 955 960	
gcg ggt tcg cat ccg tgg ttg tcc gat cac cgg gtg ctg ggc gaa atc	2928
Ala Gly Ser His Pro Trp Leu Ser Asp His Arg Val Leu Gly Glu Ile	
965 970 975	
gtc gtc ccc ggc acc gcg atc gtc gag ctg gtg tgg cac gtc ggc gag	2976
Val Val Pro Gly Thr Ala Ile Val Glu Leu Val Trp His Val Gly Glu	
980 985 990	
cgc ctc ggt tgt ggc cgg gtg gaa gaa ctg gct ttg gaa gcg ccc ctg	3024
Arg Leu Gly Cys Gly Arg Val Glu Glu Leu Ala Leu Ala Pro Leu	
995 1000 1005	
atc ctg ccg gat cat gga gcg gtc cag gtt cag gtg ctg gtg gga ccg	3072
Ile Leu Pro Asp His Gly Ala Val Gln Val Gln Val Leu Val Gly Pro	
1010 1015 1020	
ccc ggg gaa tcc gga gcc cgg tcg gtg gcg ctc tac tcc tgt cct ggc	3120
Pro Gly Glu Ser Gly Ala Arg Ser Val Ala Leu Tyr Ser Cys Pro Gly	
1025 1030 1035 1040	
gag gcg atc gaa ccc gag tgg aag aag cac gcg acg ggc gtg ctt ctc	3168
Glu Ala Ile Glu Pro Glu Trp Lys Lys His Ala Thr Gly Val Leu Leu	
1045 1050 1055	
cca ccc gtg gcc gcc gag aac cat gag ctg acc gca tgg ccc ccg gag	3216
Pro Pro Val Ala Ala Glu Asn His Glu Leu Thr Ala Trp Pro Pro Glu	
1060 1065 1070	
aat gcg acc gaa atc gat gca gac ggg gtc tac gca ttc ctt gaa ggg	3264
Asn Ala Thr Glu Ile Asp Ala Asp Gly Val Tyr Ala Phe Leu Glu Gly	
1075 1080 1085	
cac ggt ttc gcg tac gga ccg gcc ttt aga tgt ctg cgc ggt gcc tgg	3312
His Gly Phe Ala Tyr Gly Pro Ala Phe Arg Cys Leu Arg Gly Ala Trp	
1090 1095 1100	
cga cga ggc ggg gag gtg ttc gcc gaa gtc gca ttg ccg gat gac atg	3360
Arg Arg Gly Gly Glu Val Phe Ala Glu Val Ala Leu Pro Asp Asp Met	
1105 1110 1115 1120	
cag gcg ggg gtc gat cga ttc ggc gtc cac ccc gcg ttg ctg gac gcg	3408
Gln Ala Gly Val Asp Arg Phe Gly Val His Pro Ala Leu Leu Asp Ala	

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1125	1130	1135	
gtt ctg cat gcc gcc gca gcc gag acg tcg gtg gtc cag agc gaa gcg Val Leu His Ala Ala Ala Ala Glu Thr Ser Val Val Gln Ser Glu Ala 1140 1145 1150			3456
cgg gtg ccg ttc tcg tgg cgt ggg gtg gaa ctt cgc gcc act gaa agc Arg Val Pro Phe Ser Trp Arg Gly Val Glu Leu Arg Ala Thr Glu Ser 1155 1160 1165			3504
gcg gtg gtg cgg gcg cgc ctc tcg ttg act tcg gat gac gaa ctg tcg Ala Val Val Arg Ala Arg Leu Ser Leu Thr Ser Asp Asp Glu Leu Ser 1170 1175 1180			3552
ttg gtc gca gtg gac ccg gct ggc cga ttc gtg gcc acg gtt gat tcg Leu Val Ala Val Asp Pro Ala Gly Arg Phe Val Ala Thr Val Asp Ser 1185 1190 1195 1200			3600
ctg gtg acc cga ccg atc tcc cgg cag cag gtg agg tct ggc gcg atc Leu Val Thr Arg Pro Ile Ser Arg Gln Gln Val Arg Ser Gly Ala Ile 1205 1210 1215			3648
ggc gat tgc ctg ttc gag gtg gag tgg cac cgg aag gcg ttg ttg gga Gly Asp Cys Leu Phe Glu Val Glu Trp His Arg Lys Ala Leu Leu Gly 1220 1225 1230			3696
aca acc gcc ggc gac gac ctt gcc atc gtc ggt gac ggt ccc agt tgg Thr Thr Ala Gly Asp Asp Leu Ala Ile Val Gly Asp Gly Pro Ser Trp 1235 1240 1245			3744
ccg gaa tcg gtg cgc gca acc gca cgg ttc gcg acc ctg gat gag ttc Pro Glu Ser Val Arg Ala Thr Ala Arg Phe Ala Thr Leu Asp Glu Phe 1250 1255 1260			3792
cgt gcg gcc gtg gac tcg gac gtt cct gcc ccg ggt tcg gtg ttg gtc Arg Ala Ala Val Asp Ser Asp Val Pro Ala Pro Gly Ser Val Leu Val 1265 1270 1275 1280			3840
gca gct atg tcg gcc gaa gag gtc gag ggt gga tcc ctg ccg tcg cgc Ala Ala Met Ser Ala Glu Glu Val Glu Gly Gly Ser Leu Pro Ser Arg 1285 1290 1295			3888
gcc caa gag tcg acc tcc gat ctg ctg gct ctc gtg cag tcg tgg ctt Ala Gln Glu Ser Thr Ser Asp Leu Leu Ala Leu Val Gln Ser Trp Leu 1300 1305 1310			3936
gcg gac gag cgg ttc gcc gaa tcc cag ctc gtg gtc gtc acg cgt gca Ala Asp Glu Arg Phe Ala Glu Ser Gln Leu Val Val Val Thr Arg Ala 1315 1320 1325			3984
gcg gtg tcg gcc gac tcg gat tcg gac gtc gcg gac ctg gtg ggt gcg Ala Val Ser Ala Asp Ser Asp Ser Asp Val Ala Asp Leu Val Gly Ala 1330 1335 1340			4032
tcg tcg tgg ggg ttg ttg agt tca gcc cag tcg gag aac ccg ggt cgc Ser Ser Trp Gly Leu Leu Ser Ser Ala Gln Ser Glu Asn Pro Gly Arg 1345 1350 1355 1360			4080
ttc gtg ctg gtg gac gtg gac ggc aca cct gag tcg tgg cag gcg ttg Phe Val Leu Val Asp Val Asp Gly Thr Pro Glu Ser Trp Gln Ala Leu 1365 1370 1375			4128
ccg gcc gcc gtg cga gca gga gaa ccg cag ctg gca ctt cgg cgc ggc			4176

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Pro	Ala	Ala	Val	Arg	Ala	Gly	Glu	Pro	Gln	Leu	Ala	Leu	Arg	Arg	Gly		
			1380					1385					1390				
gtg	gcg	ctg	gtg	cct	cgg	ttg	gcg	cga	ctc	acg	gtg	cgc	gag	gag	ggc	4224	
Val	Ala	Leu	Val	Pro	Arg	Leu	Ala	Arg	Leu	Thr	Val	Arg	Glu	Glu	Gly		
		1395					1400					1405					
tcc	tcc	ccg	caa	ctc	gac	acg	gac	ggg	acc	gtc	ctc	atc	acg	ggt	ggc	4272	
Ser	Ser	Pro	Gln	Leu	Asp	Thr	Asp	Gly	Thr	Val	Leu	Ile	Thr	Gly	Gly		
		1410				1415					1420						
acc	ggt	gcg	ttg	ggg	gga	gtg	gtt	gcc	cgt	cac	ctg	gtg	gag	gag	cac	4320	
Thr	Gly	Ala	Leu	Gly	Gly	Val	Val	Ala	Arg	His	Leu	Val	Glu	Glu	His		
	1425				1430					1435					1440		
ggg	att	cgg	cgt	ttg	gtg	ttg	gca	ggc	cgg	cgt	ggc	tgg	aat	gcg	cct	4368	
Gly	Ile	Arg	Arg	Leu	Val	Leu	Ala	Gly	Arg	Arg	Gly	Trp	Asn	Ala	Pro		
			1445						1450					1455			
gga	gtc	cac	gag	ttg	gtg	gat	gag	ctg	gcg	cgc	gcg	ggc	gcc	gtg	gtt	4416	
Gly	Val	His	Glu	Leu	Val	Asp	Glu	Leu	Ala	Arg	Ala	Gly	Ala	Val	Val		
			1460					1465					1470				
gag	gtg	gtg	gct	tgc	gat	gtg	gct	gac	cgc	acc	gat	ctg	gag	cac	gtg	4464	
Glu	Val	Val	Ala	Cys	Asp	Val	Ala	Asp	Arg	Thr	Asp	Leu	Glu	His	Val		
	1475						1480					1485					
ctg	gcc	gcc	att	ccg	gtc	gac	tgg	ccg	ctg	cgg	ggg	atc	gtg	cat	acc	4512	
Leu	Ala	Ala	Ile	Pro	Val	Asp	Trp	Pro	Leu	Arg	Gly	Ile	Val	His	Thr		
	1490					1495					1500						
gct	ggg	gtg	ctg	gcc	gac	gga	gtg	atc	ggg	tcc	ttg	tcg	gcg	gcg	gat	4560	
Ala	Gly	Val	Leu	Ala	Asp	Gly	Val	Ile	Gly	Ser	Leu	Ser	Ala	Ala	Asp		
	1505				1510					1515					1520		
gtg	ggc	acg	gtg	ttt	gcc	ccg	aag	gtg	acg	ggg	gca	tgg	cat	ctg	cac	4608	
Val	Gly	Thr	Val	Phe	Ala	Pro	Lys	Val	Thr	Gly	Ala	Trp	His	Leu	His		
			1525						1530					1535			
gag	ttg	acc	cgc	gat	ctg	gat	ctg	tcg	ttc	ttc	gtt	ctt	ttc	tct	tcc	4656	
Glu	Leu	Thr	Arg	Asp	Leu	Asp	Leu	Ser	Phe	Phe	Val	Leu	Phe	Ser	Ser		
		1540						1545					1550				
ttc	tcc	ggg	att	gcg	ggt	gcc	gca	ggg	cag	gcc	aac	tac	gcg	gcg	gcg	4704	
Phe	Ser	Gly	Ile	Ala	Gly	Ala	Ala	Gly	Gln	Ala	Asn	Tyr	Ala	Ala	Ala		
		1555				1560						1565					
aac	acg	ttc	ctg	gat	gca	ttg	gcg	cgt	tat	cgc	cgg	gcg	cgt	ggg	ctg	4752	
Asn	Thr	Phe	Leu	Asp	Ala	Leu	Ala	Arg	Tyr	Arg	Arg	Ala	Arg	Gly	Leu		
	1570					1575					1580						
cct	ggg	ttg	tcg	ttg	gcg	tgg	gga	ctg	tgg	gcg	caa	ccc	agc	ggt	atg	4800	
Pro	Gly	Leu	Ser	Leu	Ala	Trp	Gly	Leu	Trp	Ala	Gln	Pro	Ser	Gly	Met		
	1585				1590				1595						1600		
acg	agt	ggc	ttg	gac	gcg	gcg	tcg	gtg	gag	cgg	ttg	gcg	cgg	acg	ggc	4848	
Thr	Ser	Gly	Leu	Asp	Ala	Ala	Ser	Val	Glu	Arg	Leu	Ala	Arg	Thr	Gly		
			1605					1610					1615				
atc	gca	gaa	ctt	tcc	acg	gag	gat	gga	ctc	cgc	ctg	ttc	gat	gcc	gcg	4896	
Ile	Ala	Glu	Leu	Ser	Thr	Glu	Asp	Gly	Leu	Arg	Leu	Phe	Asp	Ala	Ala		
		1620					1625						1630				

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ttc gcg aag gac cgg gct tgc gtc gtt gcc gct cga ttg gac agg gcg Phe Ala Lys Asp Arg Ala Cys Val Val Ala Ala Arg Leu Asp Arg Ala 1635 1640 1645	4944
ctg ctg gtc ggg aac gga cga tgc cac gcg att ccg gcg ctg ttg agc Leu Leu Val Gly Asn Gly Arg Ser His Ala Ile Pro Ala Leu Leu Ser 1650 1655 1660	4992
gcg ttg gtt cct gtt cgc ggc ggt gtg gcg agg aaa aca gcc aat tct Ala Leu Val Pro Val Arg Gly Gly Val Ala Arg Lys Thr Ala Asn Ser 1665 1670 1675 1680	5040
cag gcc gcg gat gag gac gca ctg ttg ggt ttg gtg ccg gag cac gtt Gln Ala Ala Asp Glu Asp Ala Leu Leu Gly Leu Val Arg Glu His Val 1685 1690 1695	5088
tcg gcc gtg ctg ggt tat tgc ggt gcg gtc gag gtt ggg ggc gac cgt Ser Ala Val Leu Gly Tyr Ser Gly Ala Val Glu Val Gly Gly Asp Arg 1700 1705 1710	5136
gct ttc cgt gat ctg ggt ttt gat tgc ttg tct ggc gtg gag ttg ccg Ala Phe Arg Asp Leu Gly Phe Asp Ser Leu Ser Gly Val Glu Leu Arg 1715 1720 1725	5184
aac cgc ctt gcc ggg gtg ctg ggg gtg ccg ttg ccg gcg act gcg gtg Asn Arg Leu Ala Gly Val Leu Gly Val Arg Leu Pro Ala Thr Ala Val 1730 1735 1740	5232
ttc gac tat ccg acg ccg cgg gcg ctg gcg cgt ttc ctg cat cag gaa Phe Asp Tyr Pro Thr Pro Arg Ala Leu Ala Arg Phe Leu His Gln Glu 1745 1750 1755 1760	5280
ctg gca ggc gag gtc gcg tcc acg tgc acg ccg gtg acc agg gca gcg Leu Ala Gly Glu Val Ala Ser Thr Ser Thr Pro Val Thr Arg Ala Ala 1765 1770 1775	5328
agt gcc gaa gag gat ctt gtt gcg att gtc ggg atg gga tgt cgt ttt Ser Ala Glu Glu Asp Leu Val Ala Ile Val Gly Met Gly Cys Arg Phe 1780 1785 1790	5376
ccg ggt ggg gtg tgc tgc ccg gag gag ctt tgg ccg ctg gtg gcc ggc Pro Gly Gly Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala Gly 1795 1800 1805	5424
ggc gtg gat gcg gtg gct ggg ttc cca gac gat cgc ggc tgg gat ctc Gly Val Asp Ala Val Ala Gly Phe Pro Asp Asp Arg Gly Trp Asp Leu 1810 1815 1820	5472
gcg gcg ttg tac gat cct gat ccc gat cgt ctc ggg acc tgc tat gtg Ala Ala Leu Tyr Asp Pro Asp Pro Asp Arg Leu Gly Thr Ser Tyr Val 1825 1830 1835 1840	5520
tgt gag ggc ggg ttt ctg cgg gac gcg gcg gag ttc gat gct gac atg Cys Glu Gly Gly Phe Leu Arg Asp Ala Ala Glu Phe Asp Ala Asp Met 1845 1850 1855	5568
ttc ggc atc agc ccg cgt gag gcg ttg gcg atg gat ccg cag cag ccg Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg 1860 1865 1870	5616
ttg ctg ctg gag gtc gcc tgg gaa acc ttg gag ccg gct ggg atc gat Leu Leu Leu Glu Val Ala Trp Glu Thr Leu Glu Arg Ala Gly Ile Asp 1875 1880 1885	5664

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ccg ttc tcg ttg cac ggc agc cgg acc ggt gtg ttc gcg ggc ttg atg Pro Phe Ser Leu His Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met 1890 1895 1900	5712
tac cac gac tat ggg gcc cga ttc att acc aga gca ccg gag ggc ttc Tyr His Asp Tyr Gly Ala Arg Phe Ile Thr Arg Ala Pro Glu Gly Phe 1905 1910 1915 1920	5760
gaa ggg cac ctc ggg acg ggc aat gcg ggg agc gtg ctg tcg ggt cgg Glu Gly His Leu Gly Thr Gly Asn Ala Gly Ser Val Leu Ser Gly Arg 1925 1930 1935	5808
gtt gcg tat tcg ttt ggt ttc gag ggt cct gcg gtg acg gtg gat acg Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr 1940 1945 1950	5856
gcg tgt tcg tcg ttg gtg gcg tta cac ctg gcg ggt caa gca ctg Ala Cys Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ala Leu 1955 1960 1965	5904
cgg gcc ggt gag tgc gaa ttc gcc ctt gcc ggt ggc gtc acg gtg atg Arg Ala Gly Glu Cys Glu Phe Ala Leu Ala Gly Gly Val Thr Val Met 1970 1975 1980	5952
tcg acg ccg acg acg ttc gtg gag ttc tcc cgt caa ccg ggt ctg gct Ser Thr Pro Thr Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala 1985 1990 1995 2000	6000
ccg gat ggg ccg tgc aag tcg ttc gcg gcg gcc gcg gat ggc acc ggg Pro Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala Asp Gly Thr Gly 2005 2010 2015	6048
tgg ggc gag ggt gcc ggt ctg gtg ttg ctg gag ccg ttg tcg gat gcc Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala 2020 2025 2030	6096
cgg cgc aat ggg cac gag gtt ctg gcg gtg gtg ccg ggt agc gcg gtg Arg Arg Asn Gly His Glu Val Leu Ala Val Val Arg Gly Ser Ala Val 2035 2040 2045	6144
aac cag gac ggc gcg tcg aat ggc ttg act gcg cca aat ggt ccg tca Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser 2050 2055 2060	6192
cag caa agg gtg atc acc cag gca ctc acg agt gcc ggg ctg tcc gtg Gln Gln Arg Val Ile Thr Gln Ala Leu Thr Ser Ala Gly Leu Ser Val 2065 2070 2075 2080	6240
tcc gac gtg gat gct gtg gag gcg cat ggg acg ggc acg ccg ctt ggt Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly 2085 2090 2095	6288
gat ccg atc gag gcg cag gcg ttg atc gct acg tac ggc ccg gat cgt Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg 2100 2105 2110	6336
gat ccc ggt ccg ccg ttg tgg ctg ggg tcg gtg aag tcg aat att ggt Asp Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly 2115 2120 2125	6384
cac acc cag gcg gcg gcg ggt gtc gct ggt gtg atc aag atg gtg atg His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met 2130 2135 2140 2145	6432

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2130	2135	2140	
gcg atg cgg cag ggg gag ctg ccg cgc acg ttg cac gtg gac gag ccc Ala Met Arg Gln Gly Glu Leu Pro Arg Thr Leu His Val Asp Glu Pro 2145 2150 2155 2160			6480
tcc gcg cag gtg gac tgg tct gcg ggc acg gtc caa ctc ctc acg gag Ser Ala Gln Val Asp Trp Ser Ala Gly Thr Val Gln Leu Leu Thr Glu 2165 2170 2175			6528
aac acg ccc tgg ccc gac agc ggt cgt ctt cgc cgg gcg ggc gtg tca Asn Thr Pro Trp Pro Asp Ser Gly Arg Leu Arg Arg Ala Gly Val Ser 2180 2185 2190			6576
tcg ttc ggg atc agt ggc acc aac gcg cac ctg atc ctt gaa caa cct Ser Phe Gly Ile Ser Gly Thr Asn Ala His Leu Ile Leu Glu Gln Pro 2195 2200 2205			6624
ccg cga gag tcg cag cgc tca aca gag ccg gat tcg ggt tct gtc cgc Pro Arg Glu Ser Gln Arg Ser Thr Glu Pro Asp Ser Gly Ser Val Arg 2210 2215 2220			6672
gat ttt ccg gtg gtg ccg tgg atg gtg tcg ggc aaa aca ccc gaa gcg Asp Phe Pro Val Val Pro Trp Met Val Ser Gly Lys Thr Pro Glu Ala 2225 2230 2235 2240			6720
cta tcc gcc cag gca gat gca ttg atg tcc tac ttg agc aat cgc gtt Leu Ser Ala Gln Ala Asp Ala Leu Met Ser Tyr Leu Ser Asn Arg Val 2245 2250 2255			6768
gat gct tcc ccg cga gat atc ggt tat tcg ctt gcg gtg acc cgt ccg Asp Ala Ser Pro Arg Asp Ile Gly Tyr Ser Leu Ala Val Thr Arg Pro 2260 2265 2270			6816
gcg ttg gac cac cgc gct gtc gtg ctg ggt gcg gat cgt gcc gcg ttg Ala Leu Asp His Arg Ala Val Val Leu Gly Ala Asp Arg Ala Ala Leu 2275 2280 2285			6864
ctg ccg ggc ttg aaa gcg ctg gcc gtt agt aat gac gct gcc gag gtg Leu Pro Gly Leu Lys Ala Leu Ala Val Ser Asn Asp Ala Ala Glu Val 2290 2295 2300			6912
atc acc ggc act cgt gcc gct ggg ccg gtc gga ttc gtg ttc tcc ggt Ile Thr Gly Thr Arg Ala Ala Gly Pro Val Gly Phe Val Phe Ser Gly 2305 2310 2315 2320			6960
caa ggt ggt cag tgg ccc ggg atg gga agc ggg ctc cac tcg gcg ttt Gln Gly Gly Gln Trp Pro Gly Met Gly Ser Gly Leu His Ser Ala Phe 2325 2330 2335			7008
ccg gtg ttc gcc gac gcg ttt gac gaa gcc tgc tgc gag ctg gat gcg Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Cys Glu Leu Asp Ala 2340 2345 2350			7056
cat ctc ggg cag atg gcc cgg cta cga gat gtg ttg tcc ggt tcg gat His Leu Gly Gln Met Ala Arg Leu Arg Asp Val Leu Ser Gly Ser Asp 2355 2360 2365			7104
acg caa ctt ctg gac cag acc ttg tgg gcg cag ccg ggc ctg ttc gcg Thr Gln Leu Leu Asp Gln Thr Leu Trp Ala Gln Pro Gly Leu Phe Ala 2370 2375 2380			7152
ttg caa gtc gga ctc tgg gag ttg ttg ggt tcg tgg ggt gtc cgg ccc			7200

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Leu Gln Val Gly Leu Trp Glu Leu Leu Gly Ser Trp Gly Val Arg Pro	
2385 2390 2395 2400	
gct gtg gtg ctg ggc cac tcg gtc ggt gag ctg gcg gcg gcg ttc gcg	7248
Ala Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe Ala	
2405 2410 2415	
gct gga gtg ttg tcg ttg cgg gat gcg gct cgg ctg gtg gcg ggc cgt	7296
Ala Gly Val Leu Ser Leu Arg Asp Ala Ala Arg Leu Val Ala Gly Arg	
2420 2425 2430	
gcc cgg ttg atg caa gcc ctg cca act ggc ggt gcc atg ctc gct gcg	7344
Ala Arg Leu Met Gln Ala Leu Pro Thr Gly Gly Ala Met Leu Ala Ala	
2435 2440 2445	
gct gct gga gag gag cag ctg cgc ccg ttg ctg gcc gac tgc ggt gat	7392
Ala Ala Gly Glu Glu Gln Leu Arg Pro Leu Leu Ala Asp Cys Gly Asp	
2450 2455 2460	
cgt gtg ggg atc gcc gcg gtc aac gct ccc ggg tcg gtg gtg ctc tcc	7440
Arg Val Gly Ile Ala Ala Val Asn Ala Pro Gly Ser Val Val Leu Ser	
2465 2470 2475 2480	
ggt gat cgg gat gtg ctc gat gac att gcc ggt cgg ctg gac ggg caa	7488
Gly Asp Arg Asp Val Leu Asp Asp Ile Ala Gly Arg Leu Asp Gly Gln	
2485 2490 2495	
ggg atc cgg tcc agg tgg ttg cgg gtt tcg cat gcg ttt cat tcg cat	7536
Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser His	
2500 2505 2510	
cgg atg gat ccg atg ctg gcg gag ttc acc gaa atc gcc cgg agc gtg	7584
Arg Met Asp Pro Met Leu Ala Glu Phe Thr Glu Ile Ala Arg Ser Val	
2515 2520 2525	
gac tac cgg tcg tca ggg ctg ccg atc gtg tcg acg ttg acg ggt gag	7632
Asp Tyr Arg Ser Ser Gly Leu Pro Ile Val Ser Thr Leu Thr Gly Glu	
2530 2535 2540	
ctc gat gag gtc ggc atg ccg gct acg ccg gag tat tgg gtg cgc cag	7680
Leu Asp Glu Val Gly Met Pro Ala Thr Pro Glu Tyr Trp Val Arg Gln	
2545 2550 2555 2560	
gtg cga gaa ccc gtc cgc ttc gcc gac ggt gtt gct gcg ctc gcg gct	7728
Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Ala Ala Leu Ala Ala	
2565 2570 2575	
cac ggt gtg agc acc gtc gtc gag gtc ggt ccg gat ggg gtg ttg tcg	7776
His Gly Val Ser Thr Val Val Glu Val Gly Pro Asp Gly Val Leu Ser	
2580 2585 2590	
gcg ctg gtg cag gag tgc gcg gcc gga tcc gat cag ggc gga cgg gtg	7824
Ala Leu Val Gln Glu Cys Ala Ala Gly Ser Asp Gln Gly Gly Arg Val	
2595 2600 2605	
gcc gcg gtt ccg ctc atg cgc agc aat cgc gac gag gcg cac acg gtg	7872
Ala Ala Val Pro Leu Met Arg Ser Asn Arg Asp Glu Ala His Thr Val	
2610 2615 2620	
aca acg gca ttg gcg cag atc cat gtg cgt ggt gct gag gtg gac tgg	7920
Thr Thr Ala Leu Ala Gln Ile His Val Arg Gly Ala Glu Val Asp Trp	
2625 2630 2635 2640	

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cgg	tcg	ttt	ttc	gcc	ggg	acc	ggg	gca	aag	cag	gtc	gag	ctg	ccc	acg	7968
Arg	Ser	Phe	Phe	Ala	Gly	Thr	Gly	Ala	Lys	Gln	Val	Glu	Leu	Pro	Thr	
				2645				2650						2655		
tat	gcc	ttc	caa	cga	cag	cgg	tac	tgg	ctt	gac	tca	cca	tcc	gaa	ccg	8016
Tyr	Ala	Phe	Gln	Arg	Gln	Arg	Tyr	Trp	Leu	Asp	Ser	Pro	Ser	Glu	Pro	
			2660				2665					2670				
gtc	ggg	caa	tcc	gcc	gat	ccc	gcg	cgc	cag	tcg	ggc	ttc	tgg	gaa	ctc	8064
Val	Gly	Gln	Ser	Ala	Asp	Pro	Ala	Arg	Gln	Ser	Gly	Phe	Trp	Glu	Leu	
	2675						2680				2685					
gtc	gag	cag	gaa	gat	gtc	agc	gcg	ctc	agc	gcc	gct	ctg	cac	att	acc	8112
Val	Glu	Gln	Glu	Asp	Val	Ser	Ala	Leu	Ser	Ala	Ala	Leu	His	Ile	Thr	
	2690					2695				2700						
ggc	gat	cac	gac	gtg	cag	gcg	tcc	ctg	gaa	tcg	gtg	ggt	ccg	gtc	ctc	8160
Gly	Asp	His	Asp	Val	Gln	Ala	Ser	Leu	Glu	Ser	Val	Val	Pro	Val	Leu	
2705				2710				2715						2720		
tcc	tcc	tgg	cat	cgc	cgg	atc	cgc	aac	gaa	tcc	ctg	gtg	cac	cag	tgg	8208
Ser	Ser	Trp	His	Arg	Arg	Ile	Arg	Asn	Glu	Ser	Leu	Val	His	Gln	Trp	
			2725					2730					2735			
cgg	tac	cgg	att	tcc	tgg	cat	gag	cgg	gca	gat	ttg	cca	gac	ccc	tcg	8256
Arg	Tyr	Arg	Ile	Ser	Trp	His	Glu	Arg	Ala	Asp	Leu	Pro	Asp	Pro	Ser	
			2740				2745					2750				
ttg	tcg	ggg	aca	tgg	ctc	gtc	gtc	gtg	ccg	gag	ggg	tgg	tcg	gcg	agt	8304
Leu	Ser	Gly	Thr	Trp	Leu	Val	Val	Val	Pro	Glu	Gly	Trp	Ser	Ala	Ser	
	2755					2760					2765					
cgg	caa	gtt	ctg	cgt	ttc	aac	gag	atg	ttc	gag	gaa	cgg	ggt	tgc	ccg	8352
Arg	Gln	Val	Leu	Arg	Phe	Asn	Glu	Met	Phe	Glu	Glu	Arg	Gly	Cys	Pro	
	2770				2775					2780						
gca	gtt	ctg	ttc	gag	ctc	gcc	ggg	cac	gac	gag	gaa	gcc	ctg	gcg	caa	8400
Ala	Val	Leu	Phe	Glu	Leu	Ala	Gly	His	Asp	Glu	Glu	Ala	Leu	Ala	Gln	
2785				2790				2795					2800			
cga	ttc	cgc	tcg	ttg	cct	gtt	gcg	tca	ggg	gga	ata	agc	ggc	gtg	ttg	8448
Arg	Phe	Arg	Ser	Leu	Pro	Val	Ala	Ser	Gly	Gly	Ile	Ser	Gly	Val	Leu	
			2805				2810						2815			
tcc	ttg	ctg	gcg	ctg	gat	gaa	tcg	ccg	tcc	tcg	ccg	aac	gct	gct	ttg	8496
Ser	Leu	Leu	Ala	Leu	Asp	Glu	Ser	Pro	Ser	Ser	Pro	Asn	Ala	Ala	Leu	
			2820				2825					2830				
ccg	aat	ggc	gcg	ctg	aac	tcg	ttg	gta	ctg	ctg	cga	gct	ctg	cgg	gcc	8544
Pro	Asn	Gly	Ala	Leu	Asn	Ser	Leu	Val	Leu	Leu	Arg	Ala	Leu	Arg	Ala	
	2835					2840					2845					
gcg	gat	gtg	tcg	gcg	cca	ttg	tgg	ttg	gcg	acg	tgt	ggt	ggt	gtc	gcg	8592
Ala	Asp	Val	Ser	Ala	Pro	Leu	Trp	Leu	Ala	Thr	Cys	Gly	Gly	Val	Ala	
	2850				2855					2860						
gtc	ggg	gat	gtg	ccg	gtg	aac	ccg	ggg	cag	gcg	ctg	gtg	tgg	gga	ctg	8640
Val	Gly	Asp	Val	Pro	Val	Asn	Pro	Gly	Gln	Ala	Leu	Val	Trp	Gly	Leu	
2865				2870				2875					2880			
ggt	cgc	gtc	gtc	ggt	ctg	gag	cat	ccg	gcc	tgg	tgg	ggt	ggc	ctg	gtc	8688
Gly	Arg	Val	Val	Gly	Leu	Glu	His	Pro	Ala	Trp	Trp	Gly	Gly	Leu	Val	
			2885					2890				2895				



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gac	gtg	ccg	tgc	ttg	ctc	gat	gag	gac	gct	cga	gaa	cgc	ttg	tcg	gtc	8736
Asp	Val	Pro	Cys	Leu	Leu	Asp	Glu	Asp	Ala	Arg	Glu	Arg	Leu	Ser	Val	
		2900					2905					2910				
gtg	ttg	gca	ggc	ctt	ggc	gag	gac	gag	atc	gcg	gta	cgt	ccc	ggc	ggc	8784
Val	Leu	Ala	Gly	Leu	Gly	Glu	Asp	Glu	Ile	Ala	Val	Arg	Pro	Gly	Gly	
		2915				2920					2925					
gtg	ttc	gtg	cgg	cgg	ttg	gaa	cgc	gct	ggc	gcg	gcg	tcg	ggc	gcc	ggg	8832
Val	Phe	Val	Arg	Arg	Leu	Glu	Arg	Ala	Gly	Ala	Ala	Ser	Gly	Ala	Gly	
	2930				2935					2940						
tcg	gtg	tgg	cgt	cct	cgg	ggg	acg	gtg	ttg	gtg	acg	ggc	ggc	acg	ggc	8880
Ser	Val	Trp	Arg	Pro	Arg	Gly	Thr	Val	Leu	Val	Thr	Gly	Gly	Thr	Gly	
	2945			2950				2955						2960		
ggc	ttg	ggg	gcg	cat	gtt	gcc	cgg	tgg	ttg	gcg	ggc	gcc	ggg	gct	gag	8928
Gly	Leu	Gly	Ala	His	Val	Ala	Arg	Trp	Leu	Ala	Gly	Ala	Gly	Ala	Glu	
			2965					2970					2975			
cat	gtg	gtg	ttg	acc	agc	cgt	cga	ggc	gcg	gcg	gct	ccg	ggc	gct	gga	8976
His	Val	Val	Leu	Thr	Ser	Arg	Arg	Gly	Ala	Ala	Ala	Pro	Gly	Ala	Gly	
		2980					2985					2990				
gat	ttg	cgg	gcg	gag	ctg	gag	gcg	ctg	ggc	gct	cgg	gtt	tcg	atc	acg	9024
Asp	Leu	Arg	Ala	Glu	Leu	Glu	Ala	Leu	Gly	Ala	Arg	Val	Ser	Ile	Thr	
	2995				3000						3005					
gcc	tgc	gac	gtg	gcc	gat	cgt	gac	gct	ttg	gcc	gaa	gtg	ttg	gcg	acc	9072
Ala	Cys	Asp	Val	Ala	Asp	Arg	Asp	Ala	Leu	Ala	Glu	Val	Leu	Ala	Thr	
	3010				3015				3020							
att	ccg	gat	gat	tgc	ccg	ctg	acc	gcg	gtg	atg	cat	gcg	gcg	ggg	gtc	9120
Ile	Pro	Asp	Asp	Cys	Pro	Leu	Thr	Ala	Val	Met	His	Ala	Ala	Gly	Val	
	3025			3030				3035						3040		
gtt	gaa	gtc	ggc	gac	gtg	gcg	tcg	atg	tgt	ttg	acc	gac	ttc	gtt	ggg	9168
Val	Glu	Val	Gly	Asp	Val	Ala	Ser	Met	Cys	Leu	Thr	Asp	Phe	Val	Gly	
			3045					3050					3055			
gtg	ctg	tcg	gcg	aag	gca	ggc	ggc	gct	tat	gcg	gcg	gcg	aat	ctc	ctc	9216
Val	Leu	Ser	Ala	Lys	Ala	Gly	Gly	Ala	Ala	Ala	Asn	Leu	Asp	Glu	Leu	
		3060				3065						3070				
gcc	gat	gtc	gag	ctg	gat	gcc	ttc	gtg	ctg	ttc	tca	tcc	gtc	tcg	ggc	9264
Ala	Asp	Val	Glu	Leu	Asp	Ala	Phe	Val	Leu	Phe	Ser	Ser	Val	Ser	Gly	
	3075				3080			3085								
gtg	tgg	ggc	gct	ggc	ggg	cag	ggc	gct	tat	gcg	gcg	gcg	aat	gcc	tac	9312
Val	Trp	Gly	Ala	Gly	Gly	Gln	Gly	Ala	Tyr	Ala	Ala	Ala	Asn	Ala	Tyr	
	3090			3095				3100								
ttg	gat	gcg	ttg	gcg	cag	cgt	cgg	gca	agg	ggg	ttg	gtg	ggg	act		9360
Leu	Asp	Ala	Leu	Ala	Gln	Arg	Arg	Ala	Arg	Gly	Leu	Val	Gly	Thr		
	3105			3110				3115				3120				
gcg	gtt	gcg	tgg	ggc	ccg	tgg	gcc	ggc	gac	gga	atg	gcc	gca	ggc	gaa	9408
Ala	Val	Ala	Trp	Gly	Pro	Trp	Ala	Gly	Asp	Gly	Met	Ala	Ala	Gly	Glu	
		3125				3130						3135				
ggc	ggc	gca	cag	ctg	cgc	cgg	gcc	ggc	ctg	gtg	cca	atg	gct	gcg	gat	9456
Gly	Gly	Ala	Gln	Leu	Arg	Arg	Ala	Gly	Leu	Val	Pro	Met	Ala	Ala	Asp	

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3140	3145	3150	
cgg gcg ttg ctg gca ctt cag ggc gca ttg gat cgt gac gag aca tcc			9504
Arg Ala Leu Leu Ala Leu Gln Gly Ala Leu Asp Arg Asp Glu Thr Ser			
3155	3160	3165	
ctg gtc gtg gcc gat atg gcg tgg gag agg ttc gcc ccg gtg ttc gcc			9552
Leu Val Val Ala Asp Met Ala Trp Glu Arg Phe Ala Pro Val Phe Ala			
3170	3175	3180	
atg tcc cgt cgg cgt ccg ctg ctc gac gag ctg ccc gaa gca cag cag			9600
Met Ser Arg Arg Arg Pro Leu Leu Asp Glu Leu Pro Glu Ala Gln Gln			
3185	3190	3195	3200
gcg ttg gcg gat gcg gag aac acc act gat gct gcg gac tcg gcc gtc			9648
Ala Leu Ala Asp Ala Glu Asn Thr Thr Asp Ala Ala Asp Ser Ala Val			
3205	3210	3215	
ccg cta ccg cgg ctc gcg ggc atg gca gcc gcc gaa cgc cgc cgc gcg			9696
Pro Leu Pro Arg Leu Ala Gly Met Ala Ala Ala Glu Arg Arg Arg Ala			
3220	3225	3230	
atg ctg gac ctg gtg ctg gcg gag gcc tcg att gtg ttg gga cac aac			9744
Met Leu Asp Leu Val Leu Ala Glu Ala Ser Ile Val Leu Gly His Asn			
3235	3240	3245	
ggg tct gac cca gtt ggt ccc gac cgg gcg ttc cag gag ctc gga ttt			9792
Gly Ser Asp Pro Val Gly Pro Asp Arg Ala Phe Gln Glu Leu Gly Phe			
3250	3255	3260	
gat tcg ctg atg gcc gtc gaa ctg cgc aac agg ttg ggc gag gca aca			9840
Asp Ser Leu Met Ala Val Glu Leu Arg Asn Arg Leu Gly Glu Ala Thr			
3265	3270	3275	3280
gga ttg agt ctg ccg gcc acg ttg atc ttc gat tat ccg agc cca tcc			9888
Gly Leu Ser Leu Pro Ala Thr Leu Ile Phe Asp Tyr Pro Ser Pro Ser			
3285	3290	3295	
gcg ctg gct gag cag ctg gtc ggc gag ctg gtg gga gcg cag ccc gcg			9936
Ala Leu Ala Glu Gln Leu Val Gly Glu Leu Val Gly Ala Gln Pro Ala			
3300	3305	3310	
acc acc gtc gtg gcc ggg gcc gat cca gtg gat gat ccg gtt gtc gtg			9984
Thr Thr Val Val Ala Gly Ala Asp Pro Val Asp Asp Pro Val Val Val			
3315	3320	3325	
gtc gcg atg gga tgc cgg tat ccg ggc gac gtc tgc tcg ccc gag gag			10032
Val Ala Met Gly Cys Arg Tyr Pro Gly Asp Val Cys Ser Pro Glu Glu			
3330	3335	3340	
ctg tgg cag ctg gtt tct gcg gga cgt gat gcg gta tcg acg ttc ccc			10080
Leu Trp Gln Leu Val Ser Ala Gly Arg Asp Ala Val Ser Thr Phe Pro			
3345	3350	3355	3360
gtc gat cgg ggt tgg gac tgc aac acg ttg ttc gac ccg gat ccg gat			10128
Val Asp Arg Gly Trp Asp Cys Asn Thr Leu Phe Asp Pro Asp Pro Asp			
3365	3370	3375	
cgg gca ggc agt acc tat gtg cga gaa ggt gcc ttc ctg acc ggt gct			10176
Arg Ala Gly Ser Thr Tyr Val Arg Glu Gly Ala Phe Leu Thr Gly Ala			
3380	3385	3390	
gat cgg ttc gac gcc ggg ttc ttc ggc atc agc cct cgc gag gcg cgc			10224

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Asp	Arg	Phe	Asp	Ala	Gly	Phe	Phe	Gly	Ile	Ser	Pro	Arg	Glu	Ala	Arg		
		3395					3400					3405					
gca	atg	gat	ccg	cag	cag	agg	ttg	ttg	ctc	gaa	gtg	gcg	tgg	gag	gtt	10272	
Ala	Met	Asp	Pro	Gln	Gln	Arg	Leu	Leu	Leu	Glu	Val	Ala	Trp	Glu	Val		
	3410					3415					3420						
ttc	gaa	cga	gca	gga	atc	gct	ccg	ctg	tcg	ttg	cgg	ggt	agc	agg	acc	10320	
Phe	Glu	Arg	Ala	Gly	Ile	Ala	Pro	Leu	Ser	Leu	Arg	Gly	Ser	Arg	Thr		
	3425				3430					3435					3440		
ggt	gtg	ttc	gcg	ggg	acc	aat	ggg	cag	gac	cac	ggt	gcg	aaa	gtg	gct	10368	
Gly	Val	Phe	Ala	Gly	Thr	Asn	Gly	Gln	Asp	His	Gly	Ala	Lys	Val	Ala		
				3445					3450					3455			
gcc	gcg	ccg	gag	gcg	gcg	ggt	cac	ctc	ctg	acc	gga	aac	gcc	gcg	agt	10416	
Ala	Ala	Pro	Glu	Ala	Ala	Gly	His	Leu	Leu	Thr	Gly	Asn	Ala	Ala	Ser		
			3460					3465				3470					
gtc	ctg	gcc	ggc	cgg	ctt	tcc	tac	acg	ttc	ggc	ctt	gag	ggg	cct	gcg	10464	
Val	Leu	Ala	Gly	Arg	Leu	Ser	Tyr	Thr	Phe	Gly	Leu	Glu	Gly	Pro	Ala		
		3475					3480					3485					
gtg	gcg	gtg	gat	acc	gcg	tgt	tcg	tcg	tcg	ttg	gtg	gcg	ttg	cat	ttg	10512	
Val	Ala	Val	Asp	Thr	Ala	Cys	Ser	Ser	Ser	Leu	Val	Ala	Leu	His	Leu		
	3490					3495				3500							
gcg	tgc	cag	tcg	ctg	cgt	tcg	ggt	gag	tgt	gat	atg	gcg	ttg	gca	ggt	10560	
Ala	Cys	Gln	Ser	Leu	Arg	Ser	Gly	Glu	Cys	Asp	Met	Ala	Leu	Ala	Gly		
	3505				3510					3515					3520		
ggt	gtg	acg	gtg	atg	tcg	aca	ccc	ctg	gct	ttc	ctc	gag	ttc	tct	cgt	10608	
Gly	Val	Thr	Val	Met	Ser	Thr	Pro	Leu	Ala	Phe	Leu	Glu	Phe	Ser	Arg		
				3525					3530					3535			
cag	cgc	ggt	ttg	gcg	cca	gat	ggt	cgg	tgc	aag	tcg	ttt	gcg	gcc	gct	10656	
Gln	Arg	Gly	Leu	Ala	Pro	Asp	Gly	Arg	Cys	Lys	Ser	Phe	Ala	Ala	Ala		
		3540						3545					3550				
gcg	gat	ggc	acc	ggg	tgg	ggt	gag	ggt	gcc	ggc	ctg	gtg	ttg	ctg	gag	10704	
Ala	Asp	Gly	Thr	Gly	Trp	Gly	Glu	Gly	Ala	Gly	Leu	Val	Leu	Leu	Glu		
		3555				3560						3565					
cgg	ttg	tcg	gat	gct	cgt	cgg	aat	ggt	cac	cgg	gtg	ttg	gcc	gtg	gtt	10752	
Arg	Leu	Ser	Asp	Ala	Arg	Arg	Asn	Gly	His	Arg	Val	Leu	Ala	Val	Val		
	3570					3575					3580						
cgc	ggg	tct	gcg	gtg	aat	cag	gat	ggt	gcg	tcg	aat	ggc	ctg	act	gcg	10800	
Arg	Gly	Ser	Ala	Val	Asn	Gln	Asp	Gly	Ala	Ser	Asn	Gly	Leu	Thr	Ala		
	3585				3590					3595					3600		
ccg	aat	ggt	ccg	tcg	cag	cag	cgg	gtg	att	cgg	cag	gcc	ctc	gcg	aat	10848	
Pro	Asn	Gly	Pro	Ser	Gln	Gln	Arg	Val	Ile	Arg	Gln	Ala	Leu	Ala	Asn		
				3605					3610				3615				
gcg	ggg	ctg	tcg	gcg	tcc	gat	gtg	gat	gtc	gtg	gag	gcg	cac	ggg	acc	10896	
Ala	Gly	Leu	Ser	Ala	Ser	Asp	Val	Asp	Val	Val	Glu	Ala	His	Gly	Thr		
			3620					3625					3630				
ggt	acc	ggg	ctc	ggg	gat	ccg	atc	gag	gcg	cag	gcg	ctg	atc	gcg	aca	10944	
Gly	Thr	Gly	Leu	Gly	Asp	Pro	Ile	Glu	Ala	Gln	Ala	Leu	Ile	Ala	Thr		
		3635					3640					3645					

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tat ggg cag gag cgg gat cct gag cgg gcc ctg tgg ctg ggg tcg atc Tyr Gly Gln Glu Arg Asp Pro Glu Arg Ala Leu Trp Leu Gly Ser Ile 3650 3655 3660	10992
aag tcc aac atc ggc cac acg cag gcg gcg gcc ggt gtg gcg ggg gtc Lys Ser Asn Ile Gly His Thr Gln Ala Ala Gly Val Ala Gly Val 3665 3670 3675 3680	11040
atc aag atg gtg cag gcc atg cgg cac ggg gag ttg cct gcg acg ttg Ile Lys Met Val Gln Ala Met Arg His Gly Glu Leu Pro Ala Thr Leu 3685 3690 3695	11088
cac gtg gac aag ccc act cca cag gtg gac tgg tct gcc ggg gcc gtt His Val Asp Lys Pro Thr Pro Gln Val Asp Trp Ser Ala Gly Ala Val 3700 3705 3710	11136
cgg ctc ctc acc ggg aac acg ccc tgg ccc gag agc ggc cgt cct cgt Arg Leu Leu Thr Gly Asn Thr Pro Trp Pro Glu Ser Gly Arg Pro Arg 3715 3720 3725	11184
cga gcg ggg gtg tcg tcg ttc ggg atc agc ggc acc aac gca cac ctc Arg Ala Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Leu 3730 3735 3740	11232
atc ctc gaa caa cca ccg tcg gaa cca gcg gag atc gac caa tcg gat Ile Leu Glu Gln Pro Pro Ser Glu Pro Ala Glu Ile Asp Gln Ser Asp 3745 3750 3755 3760	11280
cgg cgg gtc act gcg cat cca gcg gtg atc ccg tgg atg ttg tcg gct Arg Arg Val Thr Ala His Pro Ala Val Ile Pro Trp Met Leu Ser Ala 3765 3770 3775	11328
agg agt ctc gca gcg ctg cag gcc caa gcg gct gcg ctg cag gcc cgg Arg Ser Leu Ala Ala Leu Gln Ala Gln Ala Ala Leu Gln Ala Arg 3780 3785 3790	11376
ctg gac cgg ggt cct ggc gct tct ccg ctg gat ttg ggg tat tca ctc Leu Asp Arg Gly Pro Gly Ala Ser Pro Leu Asp Leu Gly Tyr Ser Leu 3795 3800 3805	11424
gcg acc act cgt tct gtg ctg gac gaa cgc gcc gtc gtg tgg ggt gcc Ala Thr Thr Arg Ser Val Leu Asp Glu Arg Ala Val Val Trp Gly Ala 3810 3815 3820	11472
gat cgg gag gca ctg ctg tcc agg ctg gca gcg ctc gcc gat ggc cgg Asp Arg Glu Ala Leu Leu Ser Arg Leu Ala Ala Leu Ala Asp Gly Arg 3825 3830 3835 3840	11520
acg gcg ccg ggg gtg ata acg ggc tct gcg aat tcc ggt ggc cgc atc Thr Ala Pro Gly Val Ile Thr Gly Ser Ala Asn Ser Gly Gly Arg Ile 3845 3850 3855	11568
gga ttc gtt ttt tcc ggt cag ggc agt cag tgg ctg ggg atg gga aag Gly Phe Val Phe Ser Gly Gln Gly Ser Gln Trp Leu Gly Met Gly Lys 3860 3865 3870	11616
gcg ttg tgc gcg gct ttc ccg gcg ttc gcg gac gcc ttc gag gaa gcc Ala Leu Cys Ala Ala Phe Pro Ala Phe Ala Asp Ala Phe Glu Glu Ala 3875 3880 3885	11664
tgc gac gcg cta agc gca cac ctg ggc gcg gac gtt cgg ggt gtg ctg Cys Asp Ala Leu Ser Ala His Leu Gly Ala Asp Val Arg Gly Val Leu 3890 3895 3900	11712

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ttc ggt gct gat gag cag atg ctc gac cgg acg ctg tgg gcg cag tcg Phe Gly Ala Asp Glu Gln Met Leu Asp Arg Thr Leu Trp Ala Gln Ser 3905 3910 3915 3920	11760
ggg atc ttc gcg gtt caa gtc ggc ctc ctg gga ttg ctg agg tcg tgg Gly Ile Phe Ala Val Gln Val Gly Leu Gly Leu Leu Arg Ser Trp 3925 3930 3935	11808
ggc gtg cgg ccg gcc gcg gtg ctg ggg cac tcg gtc ggc gag ttg gct Gly Val Arg Pro Ala Ala Val Leu Gly His Ser Val Gly Glu Leu Ala 3940 3945 3950	11856
gcg gcg cac gcg gct ggt gtg ttg tcc ttg ccg gac gct gca cgg ttg Ala Ala His Ala Ala Gly Val Leu Ser Leu Pro Asp Ala Ala Arg Leu 3955 3960 3965	11904
gtt gcg gct cgg gcc cac ctg atg cag gca ttg ccc acc ggc ggc gca Val Ala Ala Arg Ala His Leu Met Gln Ala Leu Pro Thr Gly Gly Ala 3970 3975 3980	11952
atg ctc gcg gtc gcc acc agc gag gcg gcg gtc gga ccg ctg ctt tcc Met Leu Ala Val Ala Thr Ser Glu Ala Ala Val Gly Pro Leu Leu Ser 3985 3990 3995 4000	12000
ggg gtg tgc gat cgg gtc agc atc gct gcg atc aac ggc ccc gag tcg Gly Val Cys Asp Arg Val Ser Ile Ala Ala Ile Asn Gly Pro Glu Ser 4005 4010 4015	12048
gta gtg ctc tcc ggc gac cgc gat gtg ctc gtg gag ctc gca ggc gaa Val Val Leu Ser Gly Asp Arg Asp Val Leu Val Glu Leu Ala Gly Glu 4020 4025 4030	12096
ttc gat gcc cga ggg ctt agg acc aaa tgg ttg cgg gtc tcc cat gct Phe Asp Ala Arg Gly Leu Arg Thr Lys Trp Leu Arg Val Ser His Ala 4035 4040 4045	12144
ttc cac tcg cac cgg atg gaa ccg att ctg gac gag tac gcg gaa acc Phe His Ser His Arg Met Glu Pro Ile Leu Asp Glu Tyr Ala Glu Thr 4050 4055 4060	12192
gcc agg tgc gtc gag ttc ggt gaa ccg gtg gtg ccg atc gtc tcc gcc Ala Arg Cys Val Glu Phe Gly Glu Pro Val Val Pro Ile Val Ser Ala 4065 4070 4075 4080	12240
gcg acc ggt gcg ctg gac acc acc gga ctg atg tgc gcg gcc gac tac Ala Thr Gly Ala Leu Asp Thr Thr Gly Leu Met Cys Ala Ala Asp Tyr 4085 4090 4095	12288
tgg acg cgc caa gtg cgt gat cct gtc cgc ttc gga gac ggt gtc cgg Trp Thr Arg Gln Val Arg Asp Pro Val Arg Phe Gly Asp Gly Val Arg 4100 4105 4110	12336
gcg ctc gtc ggc caa ggc gtg gac acg atc gtc gag ttc ggc ccg gac Ala Leu Val Gly Gln Gly Val Asp Thr Ile Val Glu Phe Gly Pro Asp 4115 4120 4125	12384
ggg gcg ttg tcg gcc ctg gtc gag cag tgc ttg gcc ggg tcc gac cag Gly Ala Leu Ser Ala Leu Val Glu Gln Cys Leu Ala Gly Ser Asp Gln 4130 4135 4140	12432
gct ggg agg gtg gcg gcg atc ccg ctg atg cgc agg gac cgc gat gag Ala Gly Arg Val Ala Ala Ile Pro Leu Met Arg Arg Asp Arg Asp Glu 4145 4150 4155	12480

4145	4150	LeA33955-US 4155	4160		
gtc gag acc gcg gtg gcg gcc ctg gcg cac gtg cac gtc cgc ggt ggt Val Glu Thr Ala Val Ala Ala Leu Ala His Val His Val Arg Gly Gly	4165	4170	4175	12528	
gcg gtg gac tgg tcg gct tgc ttc gcc ggc acc ggc gcc cgc acc gtc Ala Val Asp Trp Ser Ala Cys Phe Ala Gly Thr Gly Ala Arg Thr Val	4180	4185	4190	12576	
gag ttg ccc acc tac gcc ttc caa cgc cag cgg tac tgg ctg gcc ggg Glu Leu Pro Thr Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Ala Gly	4195	4200	4205	12624	
caa gcg gac ggg cgc ggc ggc gat gtg gtt gcc gac ccg gtc gac gcg Gln Ala Asp Gly Arg Gly Gly Asp Val Val Ala Asp Pro Val Asp Ala	4210	4215	4220	12672	
cgc ttc tgg gag ttg gtc gag cgc gcc gat ccg gaa ccg ttg gtg gat Arg Phe Trp Glu Leu Val Glu Arg Ala Asp Pro Glu Pro Leu Val Asp	4225	4230	4235	12720	
gaa ctc tgc atc gac cgg gac cag ccc ttc cgg gag gtg ctg ccc gtt Glu Leu Cys Ile Asp Arg Asp Gln Pro Phe Arg Glu Val Leu Pro Val	4245	4250	4255	12768	
ctg gct tcc tgg cgc gag aaa caa cgc cag gag gcc ctc gcg gat tcc Leu Ala Ser Trp Arg Glu Lys Gln Arg Gln Glu Ala Leu Ala Asp Ser	4260	4265	4270	12816	
tgg cgc tac cag gtg cgc tgg agg tcc gtc gag gtg ccg tcc gca gcc Trp Arg Tyr Gln Val Arg Trp Arg Ser Val Glu Val Pro Ser Ala Ala	4275	4280	4285	12864	
gcc ctc cgg ggc gtg tgg ctg gtg gtg ctt cca gct gac gtg ccc cga Ala Leu Arg Gly Val Trp Leu Val Val Leu Pro Ala Asp Val Pro Arg	4290	4295	4300	12912	
gat caa ccg gcg gtc gtc atc gac gcg ctg atc gcg cgc ggc gcc gag Asp Gln Pro Ala Val Val Ile Asp Ala Leu Ile Ala Arg Gly Ala Glu	4305	4310	4315	12960	
gtc gcg gtc ctg gaa ttg acc gag cag gac ctc caa cgc agt gcg ctt Val Ala Val Leu Glu Leu Thr Glu Gln Asp Leu Gln Arg Ser Ala Leu	4325	4330	4335	13008	
gtg gac aag gtg cgc gcc gtc att gcg gac cgc acc gag gtg acg ggt Val Asp Lys Val Arg Ala Val Ile Ala Asp Arg Thr Glu Val Thr Gly	4340	4345	4350	13056	
gtg ttg tct ctg ttg gcg atg gac ggc atg ccc tgc gcg gcg cat ccg Val Leu Ser Leu Leu Ala Met Asp Gly Met Pro Cys Ala Ala His Pro	4355	4360	4365	13104	
cac ctg tcc cgt ggt gtc gcc gct acc gtg atc ctg acg cag gtg ttg His Leu Ser Arg Gly Val Ala Ala Thr Val Ile Leu Thr Gln Val Leu	4370	4375	4380	13152	
ggc gat gcg ggt gtt tcc gcc ccg ctg tgg ctg gcc acg acc ggt ggc Gly Asp Ala Gly Val Ser Ala Pro Leu Trp Leu Ala Thr Thr Gly Gly	4385	4390	4395	4400	13200
gtc gag gcc ggg acc gag gac ggt ccg gcc gat ccg gac cac ggc ttg				13248	

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Val	Glu	Ala	Gly	Thr	Glu	Asp	Gly	Pro	Ala	Asp	Pro	Asp	His	Gly	Leu	
			4405						4410					4415		
atc	tgg	ggg	ctc	ggc	agg	gtc	gtc	ggc	ctt	gaa	cat	ccg	cag	tgg	tgg	13296
Ile	Trp	Gly	Leu	Gly	Arg	Val	Val	Gly	Leu	Glu	His	Pro	Gln	Trp	Trp	
			4420					4425					4430			
ggt	ggc	ctg	atc	gac	ctt	ccg	gag	aca	ctg	gac	gag	acg	tcc	cgg	aac	13344
Gly	Gly	Leu	Ile	Asp	Leu	Pro	Glu	Thr	Leu	Asp	Glu	Thr	Ser	Arg	Asn	
			4435				4440					4445				
ggg	ttg	gtg	gcc	gca	ctc	gcc	ggg	acg	gcg	gcc	gaa	gat	cag	ctc	gcc	13392
Gly	Leu	Val	Ala	Ala	Leu	Ala	Gly	Thr	Ala	Ala	Glu	Asp	Gln	Leu	Ala	
			4450			4455					4460					
gtg	cgt	tca	tcc	ggg	ttg	ttc	gtt	cgc	aga	gtg	gtg	cgc	gca	gcg	cgg	13440
Val	Arg	Ser	Ser	Gly	Leu	Phe	Val	Arg	Arg	Val	Val	Arg	Ala	Ala	Arg	
					4470					4475					4480	
aac	ccc	cgg	tca	gag	aca	tgg	cgt	agc	cgg	gga	acg	gtc	ctc	atc	acg	13488
Asn	Pro	Arg	Ser	Glu	Thr	Trp	Arg	Ser	Arg	Gly	Thr	Val	Leu	Ile	Thr	
				4485					4490					4495		
ggc	gga	aca	ggc	gcg	ctc	ggt	gcc	gag	gtc	gca	cga	tgg	ctg	gcc	cgg	13536
Gly	Gly	Thr	Gly	Ala	Leu	Gly	Ala	Glu	Val	Ala	Arg	Trp	Leu	Ala	Arg	
			4500					4505					4510			
cgg	gga	gct	gag	cac	ctg	gtg	ttg	atc	agt	cgc	cgc	ggc	ccg	gaa	gct	13584
Arg	Gly	Ala	Glu	His	Leu	Val	Leu	Ile	Ser	Arg	Arg	Gly	Pro	Glu	Ala	
			4515				4520					4525				
ccc	ggc	gca	gcg	gac	cta	ggg	gcc	gag	ctg	act	gaa	ctc	ggc	gtg	aaa	13632
Pro	Gly	Ala	Ala	Asp	Leu	Gly	Ala	Glu	Leu	Thr	Glu	Leu	Gly	Val	Lys	
			4530			4535					4540					
gtc	aca	gtc	ttg	gcc	tgc	gat	gtg	acg	gac	cgc	gac	gag	ctg	gcg	gcg	13680
Val	Thr	Val	Leu	Ala	Cys	Asp	Val	Thr	Asp	Arg	Asp	Glu	Leu	Ala	Ala	
					4550					4555					4560	
gtg	ctg	gcg	gcc	gtt	ccc	acg	gag	tat	ccg	ctg	tcg	gcg	gtc	gtg	cac	13728
Val	Leu	Ala	Ala	Val	Pro	Thr	Glu	Tyr	Pro	Leu	Ser	Ala	Val	Val	His	
				4565					4570					4575		
acc	gcc	ggc	gtc	ggg	acg	cct	gcg	aac	ctg	gcc	gag	acg	acc	ttg	gcg	13776
Thr	Ala	Gly	Val	Gly	Thr	Pro	Ala	Asn	Leu	Ala	Glu	Thr	Thr	Leu	Ala	
			4580					4585					4590			
cag	ttc	gcc	gac	gtg	ttg	tcg	gcc	aag	gtc	gtc	ggc	gcg	gcg	aac	ctg	13824
Gln	Phe	Ala	Asp	Val	Leu	Ser	Ala	Lys	Val	Val	Gly	Ala	Ala	Asn	Leu	
			4595				4600					4605				
gac	cgg	ctg	ctt	ggc	ggg	caa	ccg	ttg	gac	gcc	ttc	gtg	ctg	ttc	tcc	13872
Asp	Arg	Leu	Leu	Gly	Gly	Gln	Pro	Leu	Asp	Ala	Phe	Val	Leu	Phe	Ser	
			4610			4615					4620					
tcg	atc	tcg	gga	gtt	tgg	gga	gcc	ggc	ggc	caa	gga	gcc	tat	tcg	gcc	13920
Ser	Ile	Ser	Gly	Val	Trp	Gly	Ala	Gly	Gly	Gln	Gly	Ala	Tyr	Ser	Ala	
					4630					4635					4640	
gcc	aat	gcg	tat	ctc	gat	gcc	ctt	gcc	gag	cgc	cga	cgg	gct	tgc	ggg	13968
Ala	Asn	Ala	Tyr	Leu	Asp	Ala	Leu	Ala	Glu	Arg	Arg	Arg	Ala	Cys	Gly	
				4645					4650					4655		

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cgg ccg gcg acg tgc atc gcc tgg ggt ccg tgg gcg ggt gcg ggc atg Arg Pro Ala Thr Cys Ile Ala Trp Gly Pro Trp Ala Gly Ala Gly Met 4660 4665 4670	14016
gcc gtt cag gaa ggt aac gag gcg cat ctc cgc cga agg ggc ctg gta Ala Val Gln Glu Gly Asn Glu Ala His Leu Arg Arg Arg Gly Leu Val 4675 4680 4685	14064
ccg atg gaa ccg cag tcg gcc ctc ttc gcg ctg caa cag gcc ctg tcc Pro Met Glu Pro Gln Ser Ala Leu Phe Ala Leu Gln Gln Ala Leu Ser 4690 4695 4700	14112
caa cga gaa acc gcc atc acc gtc gca gat gtg gac tgg gag cga ttc Gln Arg Glu Thr Ala Ile Thr Val Ala Asp Val Asp Trp Glu Arg Phe 4705 4710 4715 4720	14160
gcc gcc tct ttc acc gcg gcc cgc ccg cga cca ctg ttg gaa gag atc Ala Ala Ser Phe Thr Ala Ala Arg Pro Arg Pro Leu Leu Glu Glu Ile 4725 4730 4735	14208
gtg gat cta cgg ccc gac acc gag acc gag gag aag cac ggt gcc ggc Val Asp Leu Arg Pro Asp Thr Glu Thr Glu Glu Lys His Gly Ala Gly 4740 4745 4750	14256
gag ctg ggg cag cag ctg gcc gca ctg ccg ccc gct gag cgc gga cac Glu Leu Gly Gln Gln Leu Ala Ala Leu Pro Pro Ala Glu Arg Gly His 4755 4760 4765	14304
ctg ctg ctg gag gtg gtg ctg gcg gaa acc gcc agc acc ctg ggg cac Leu Leu Leu Glu Val Val Leu Ala Glu Thr Ala Ser Thr Leu Gly His 4770 4775 4780	14352
gat tcg gcg gag gct gtg caa ccc gat ccg acc ttc gcc gaa ctg ggc Asp Ser Ala Glu Ala Val Gln Pro Asp Arg Thr Phe Ala Glu Leu Gly 4785 4790 4795 4800	14400
ttc gat tcg ctg acc gcg gta gag ctg cgc aac agg ttg aac gcg gtg Phe Asp Ser Leu Thr Ala Val Glu Leu Arg Asn Arg Leu Asn Ala Val 4805 4810 4815	14448
acc ggg ctt cgc ctg ccg ccg acg ctg gtt ttc gac cac ccg acg ccg Thr Gly Leu Arg Leu Pro Pro Thr Leu Val Phe Asp His Pro Thr Pro 4820 4825 4830	14496
ctg gcg ttg tcc gaa cag ttg gtt ccg gcc ctg gtc gcg gag ccg gac Leu Ala Leu Ser Glu Gln Leu Val Pro Ala Leu Val Ala Glu Pro Asp 4835 4840 4845	14544
aac ggc atc gaa tcg ctg ctc gcc gag ctc gac agg ctg gat acc acg Asn Gly Ile Glu Ser Leu Leu Ala Glu Leu Asp Arg Leu Asp Thr Thr 4850 4855 4860	14592
ttg gcg caa ggg cct tcg atc cca ctg gaa gac cag gcc aag gtg gcg Leu Ala Gln Gly Pro Ser Ile Pro Leu Glu Asp Gln Ala Lys Val Ala 4865 4870 4875 4880	14640
gag cgc ttg cac gca ctc ctc gcc aag tgg gac ggg gcg cgt gac ggc Glu Arg Leu His Ala Leu Leu Ala Lys Trp Asp Gly Ala Arg Asp Gly 4885 4890 4895	14688
acg gcc aga gcg acg tca ccc caa tcg ctg acg gcg gcc acg gac gac Thr Ala Arg Ala Thr Ser Pro Gln Ser Leu Thr Ala Ala Thr Asp Asp 4900 4905 4910	14736



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14775

gaa atc ttc gac ctc atc gac cgg aag ttc cgg cgc tga  
 Glu Ile Phe Asp Leu Ile Asp Arg Lys Phe Arg Arg  
 4915 4920

&lt;210&gt; 48

&lt;211&gt; 4924

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 48

Met Ala Asn Glu Glu Lys Leu Phe Gly Tyr Leu Lys Lys Val Thr Ala  
 1 5 10 15  
 Asp Leu His Gln Thr Arg Gln Arg Leu Leu Ala Ala Glu Ser Arg Ser  
 20 25 30  
 Gln Glu Pro Ile Ala Ile Val Ser Ala Ser Cys Arg Leu Pro Gly Gly  
 35 40 45  
 Val Asp Ser Pro Glu Ala Leu Trp Gln Leu Val Arg Thr Gly Thr Asp  
 50 55 60  
 Ala Ile Ser Glu Phe Pro Ala Asp Arg Gly Trp Asp Leu Gly Arg Leu  
 65 70 75 80  
 Tyr Asp Pro Asp Pro Asn His Gln Gly Thr Ser Tyr Thr Arg Ala Gly  
 85 90 95  
 Gly Phe Leu Ala Gly Ala Gly Asp Phe Asp Pro Ala Met Phe Gly Ile  
 100 105 110  
 Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu  
 115 120 125  
 Glu Leu Ser Trp Glu Ala Leu Glu Arg Ala Gly Ile Asp Pro Thr Ser  
 130 135 140  
 Leu Arg Gly Ser Lys Thr Gly Val Phe Gly Gly Val Thr Pro Gln Glu  
 145 150 155 160  
 Tyr Gly Pro Ser Leu Gln Glu Met Ser Arg Asn Ala Gly Gly Phe Gly  
 165 170 175  
 Leu Thr Gly Arg Met Val Ser Val Ala Ser Gly Arg Val Ala Tyr Ser  
 180 185 190  
 Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser  
 195 200 205  
 Ser Leu Val Ala Leu His Leu Ala Cys Gln Ser Leu Arg Ser Gly Glu  
 210 215 220  
 Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met Ala Thr Pro Ala  
 225 230 235 240  
 Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg  
 245 250 255  
 Cys Lys Ser Phe Ala Ala Ala Ala Asp Gly Thr Gly Trp Gly Glu Gly  
 260 265 270

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Ala	Gly	Leu	Val	Leu	Leu	Glu	Arg	Leu	Ser	Asp	Ala	Arg	Arg	Asn	Gly
		275					280					285			
His	Glu	Val	Leu	Ala	Val	Val	Arg	Gly	Ser	Ala	Val	Asn	Gln	Asp	Gly
	290					295					300				
Ala	Ser	Asn	Gly	Leu	Thr	Ala	Pro	Asn	Gly	Pro	Ser	Gln	Gln	Arg	Val
305					310					315					320
Ile	Thr	Gln	Ala	Leu	Ala	Ser	Ala	Gly	Leu	Ser	Val	Ser	Asp	Val	Asp
				325					330					335	
Ala	Val	Glu	Ala	His	Gly	Thr	Gly	Thr	Thr	Leu	Gly	Asp	Pro	Ile	Glu
			340				345						350		
Ala	Gln	Ala	Leu	Ile	Ala	Thr	Tyr	Gly	Gln	Gly	Arg	Glu	Lys	Asp	Arg
		355					360					365			
Pro	Leu	Trp	Leu	Gly	Ser	Val	Lys	Ser	Asn	Ile	Gly	His	Thr	Gln	Ala
	370					375					380				
Ala	Ala	Gly	Val	Ala	Gly	Val	Ile	Lys	Met	Val	Leu	Ala	Met	Arg	His
385					390					395					400
Gly	Gln	Leu	Pro	Ala	Thr	Leu	His	Val	Asp	Glu	Pro	Thr	Ser	Ala	Val
				405					410					415	
Asp	Trp	Ser	Ala	Gly	Ser	Val	Arg	Leu	Leu	Thr	Glu	Asn	Thr	Pro	Trp
			420					425					430		
Pro	Asp	Ser	Gly	Arg	Pro	Cys	Arg	Val	Gly	Val	Ser	Ser	Phe	Gly	Ile
		435					440					445			
Ser	Gly	Thr	Asn	Ala	His	Val	Ile	Leu	Glu	Gln	Ser	Pro	Val	Glu	Gln
	450					455					460				
Gly	Glu	Pro	Ala	Gly	Pro	Val	Glu	Gly	Glu	Arg	Glu	Pro	Asp	Val	Ala
465					470					475					480
Val	Pro	Val	Val	Pro	Trp	Val	Leu	Ser	Gly	Lys	Thr	Pro	Glu	Ala	Ala
				485					490					495	
Arg	Ala	Gln	Ala	Glu	Arg	Val	His	Ser	His	Ile	Glu	Asp	Arg	Pro	Gly
			500					505					510		
Leu	Ser	Pro	Val	Asp	Val	Ala	Tyr	Ser	Leu	Gly	Met	Thr	Arg	Ala	Ala
		515					520					525			
Leu	Asp	Glu	Arg	Ala	Val	Val	Leu	Gly	Ser	Asp	Arg	Ala	Ala	Leu	Leu
	530					535					540				
Thr	Gly	Leu	Arg	Ala	Phe	Ala	Asp	Gly	Cys	Asp	Ala	Pro	Glu	Val	Val
545					550					555					560
Ser	Gly	Ser	Val	Gly	Leu	Gly	Gly	Arg	Val	Gly	Phe	Val	Phe	Ser	Gly
				565					570					575	
Gln	Gly	Gly	Gln	Trp	Pro	Gly	Met	Gly	Arg	Gly	Leu	Tyr	Ser	Val	Phe
			580					585					590		
Pro	Val	Phe	Ala	Asp	Ala	Phe	Asp	Glu	Ala	Cys	Ala	Glu	Leu	Asp	Ala
		595					600					605			

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His	Leu	Gly	Gln	Glu	Leu	Arg	Val	Arg	Asp	Val	Val	Phe	Gly	Ser	Gln
610						615					620				
Ala	Trp	Leu	Leu	Asp	Arg	Thr	Val	Trp	Ala	Gln	Ser	Gly	Leu	Phe	Ala
625					630					635					640
Leu	Gln	Ile	Gly	Leu	Leu	Arg	Leu	Leu	Gly	Ser	Trp	Gly	Val	Arg	Pro
				645					650					655	
Asp	Val	Val	Leu	Gly	His	Ser	Val	Gly	Glu	Leu	Ala	Ala	Val	His	Ala
			660					665					670		
Ala	Gly	Val	Leu	Ser	Leu	Ser	Glu	Ala	Ala	Arg	Leu	Val	Ala	Gly	Arg
		675					680					685			
Ala	Arg	Leu	Met	Gln	Ala	Leu	Pro	Ser	Gly	Gly	Ala	Met	Leu	Ala	Val
	690					695					700				
Ala	Thr	Gly	Glu	Phe	Gln	Val	Asp	Pro	Leu	Leu	Asp	Gly	Val	Arg	Asp
705					710					715					720
Arg	Ile	Gly	Ile	Ala	Ala	Val	Asn	Gly	Pro	Glu	Ser	Val	Val	Leu	Ser
				725					730					735	
Gly	Asp	Arg	Glu	Leu	Leu	Thr	Glu	Ile	Ala	Asp	Arg	Leu	His	Asp	Gln
			740					745					750		
Gly	Cys	Arg	Thr	Arg	Trp	Leu	Arg	Val	Ser	His	Ala	Phe	His	Ser	Pro
		755					760					765			
His	Met	Glu	Pro	Met	Leu	Glu	Glu	Phe	Ala	Gln	Ile	Ser	Arg	Gly	Arg
	770					775					780				
Glu	Tyr	His	Ala	Pro	Glu	Leu	Pro	Ile	Ile	Ser	Thr	Leu	Ile	Gly	Glu
785					790					795					800
Leu	Asp	Gly	Gly	Arg	Val	Met	Gly	Thr	Pro	Glu	Tyr	Trp	Val	Arg	Gln
				805					810					815	
Val	Arg	Glu	Pro	Val	Arg	Phe	Ala	Glu	Gly	Val	Gln	Ala	Leu	Val	Gly
			820					825					830		
Gln	Gly	Val	Gly	Thr	Ile	Val	Glu	Leu	Gly	Pro	Asp	Gly	Ala	Leu	Ser
		835					840					845			
Thr	Leu	Val	Glu	Glu	Cys	Val	Ala	Glu	Ser	Gly	Arg	Val	Ala	Gly	Ile
	850					855					860				
Pro	Leu	Met	Arg	Lys	Asp	Arg	Asp	Glu	Ala	Arg	Thr	Val	Leu	Ala	Ala
865					870					875					880
Leu	Ala	Gln	Ile	His	Thr	Arg	Gly	Gly	Glu	Val	Asp	Trp	Arg	Ser	Phe
				885					890					895	
Phe	Ala	Gly	Thr	Gly	Ala	Lys	Gln	Val	Asp	Leu	Pro	Thr	Tyr	Ala	Phe
			900					905					910		
Gln	Arg	Gln	Arg	Tyr	Trp	Leu	Ala	Ser	Thr	Gly	Arg	Ala	Gly	Asp	Val
		915					920					925			
Thr	Ala	Ala	Gly	Leu	Ala	Glu	Ala	Asp	His	Pro	Leu	Leu	Gly	Ala	Val
	930					935					940				

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Val Ala Leu Ala Asp Gly Glu Gly Val Val Leu Thr Gly Arg Leu Thr  
 945 950 955 960  
 Ala Gly Ser His Pro Trp Leu Ser Asp His Arg Val Leu Gly Glu Ile  
 965 970 975  
 Val Val Pro Gly Thr Ala Ile Val Glu Leu Val Trp His Val Gly Glu  
 980 985 990  
 Arg Leu Gly Cys Gly Arg Val Glu Glu Leu Ala Leu Glu Ala Pro Leu  
 995 1000 1005  
 Ile Leu Pro Asp His Gly Ala Val Gln Val Gln Val Leu Val Gly Pro  
 1010 1015 1020  
 Pro Gly Glu Ser Gly Ala Arg Ser Val Ala Leu Tyr Ser Cys Pro Gly  
 1025 1030 1035 1040  
 Glu Ala Ile Glu Pro Glu Trp Lys Lys His Ala Thr Gly Val Leu Leu  
 1045 1050 1055  
 Pro Pro Val Ala Ala Glu Asn His Glu Leu Thr Ala Trp Pro Pro Glu  
 1060 1065 1070  
 Asn Ala Thr Glu Ile Asp Ala Asp Gly Val Tyr Ala Phe Leu Glu Gly  
 1075 1080 1085  
 His Gly Phe Ala Tyr Gly Pro Ala Phe Arg Cys Leu Arg Gly Ala Trp  
 1090 1095 1100  
 Arg Arg Gly Gly Glu Val Phe Ala Glu Val Ala Leu Pro Asp Asp Met  
 1105 1110 1115 1120  
 Gln Ala Gly Val Asp Arg Phe Gly Val His Pro Ala Leu Leu Asp Ala  
 1125 1130 1135  
 Val Leu His Ala Ala Ala Glu Thr Ser Val Val Gln Ser Glu Ala  
 1140 1145 1150  
 Arg Val Pro Phe Ser Trp Arg Gly Val Glu Leu Arg Ala Thr Glu Ser  
 1155 1160 1165  
 Ala Val Val Arg Ala Arg Leu Ser Leu Thr Ser Asp Asp Glu Leu Ser  
 1170 1175 1180  
 Leu Val Ala Val Asp Pro Ala Gly Arg Phe Val Ala Thr Val Asp Ser  
 1185 1190 1195 1200  
 Leu Val Thr Arg Pro Ile Ser Arg Gln Gln Val Arg Ser Gly Ala Ile  
 1205 1210 1215  
 Gly Asp Cys Leu Phe Glu Val Glu Trp His Arg Lys Ala Leu Leu Gly  
 1220 1225 1230  
 Thr Thr Ala Gly Asp Asp Leu Ala Ile Val Gly Asp Gly Pro Ser Trp  
 1235 1240 1245  
 Pro Glu Ser Val Arg Ala Thr Ala Arg Phe Ala Thr Leu Asp Glu Phe  
 1250 1255 1260  
 Arg Ala Ala Val Asp Ser Asp Val Pro Ala Pro Gly Ser Val Leu Val  
 1265 1270 1275 1280

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Ala Ala Met Ser Ala Glu Glu Val Glu Gly Gly Ser Leu Pro Ser Arg  
1285 1290 1295

Ala Gln Glu Ser Thr Ser Asp Leu Leu Ala Leu Val Gln Ser Trp Leu  
1300 1305 1310

Ala Asp Glu Arg Phe Ala Glu Ser Gln Leu Val Val Val Thr Arg Ala  
1315 1320 1325

Ala Val Ser Ala Asp Ser Asp Ser Asp Val Ala Asp Leu Val Gly Ala  
1330 1335 1340

Ser Ser Trp Gly Leu Leu Ser Ser Ala Gln Ser Glu Asn Pro Gly Arg  
345 1350 1355 1360

Phe Val Leu Val Asp Val Asp Gly Thr Pro Glu Ser Trp Gln Ala Leu  
1365 1370 1375

Pro Ala Ala Val Arg Ala Gly Glu Pro Gln Leu Ala Leu Arg Arg Gly  
1380 1385 1390

Val Ala Leu Val Pro Arg Leu Ala Arg Leu Thr Val Arg Glu Glu Gly  
1395 1400 1405

Ser Ser Pro Gln Leu Asp Thr Asp Gly Thr Val Leu Ile Thr Gly Gly  
1410 1415 1420

Thr Gly Ala Leu Gly Gly Val Val Ala Arg His Leu Val Glu Glu His  
425 1430 1435 1440

Gly Ile Arg Arg Leu Val Leu Ala Gly Arg Arg Gly Trp Asn Ala Pro  
1445 1450 1455

Gly Val His Glu Leu Val Asp Glu Leu Ala Arg Ala Gly Ala Val Val  
1460 1465 1470

Glu Val Val Ala Cys Asp Val Ala Asp Arg Thr Asp Leu Glu His Val  
1475 1480 1485

Leu Ala Ala Ile Pro Val Asp Trp Pro Leu Arg Gly Ile Val His Thr  
1490 1495 1500

Ala Gly Val Leu Ala Asp Gly Val Ile Gly Ser Leu Ser Ala Ala Asp  
505 1510 1515 1520

Val Gly Thr Val Phe Ala Pro Lys Val Thr Gly Ala Trp His Leu His  
1525 1530 1535

Glu Leu Thr Arg Asp Leu Asp Leu Ser Phe Phe Val Leu Phe Ser Ser  
1540 1545 1550

Phe Ser Gly Ile Ala Gly Ala Ala Gly Gln Ala Asn Tyr Ala Ala Ala  
1555 1560 1565

Asn Thr Phe Leu Asp Ala Leu Ala Arg Tyr Arg Arg Ala Arg Gly Leu  
1570 1575 1580

Pro Gly Leu Ser Leu Ala Trp Gly Leu Trp Ala Gln Pro Ser Gly Met  
585 1590 1595 1600

Thr Ser Gly Leu Asp Ala Ala Ser Val Glu Arg Leu Ala Arg Thr Gly  
1605 1610 1615

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Ile Ala Glu Leu Ser Thr Glu Asp Gly Leu Arg Leu Phe Asp Ala Ala  
 1620 1625 1630  
 Phe Ala Lys Asp Arg Ala Cys Val Val Ala Ala Arg Leu Asp Arg Ala  
 1635 1640 1645  
 Leu Leu Val Gly Asn Gly Arg Ser His Ala Ile Pro Ala Leu Leu Ser  
 1650 1655 1660  
 Ala Leu Val Pro Val Arg Gly Gly Val Ala Arg Lys Thr Ala Asn Ser  
 665 1670 1675 1680  
 Gln Ala Ala Asp Glu Asp Ala Leu Leu Gly Leu Val Arg Glu His Val  
 1685 1690 1695  
 Ser Ala Val Leu Gly Tyr Ser Gly Ala Val Glu Val Gly Gly Asp Arg  
 1700 1705 1710  
 Ala Phe Arg Asp Leu Gly Phe Asp Ser Leu Ser Gly Val Glu Leu Arg  
 1715 1720 1725  
 Asn Arg Leu Ala Gly Val Leu Gly Val Arg Leu Pro Ala Thr Ala Val  
 1730 1735 1740  
 Phe Asp Tyr Pro Thr Pro Arg Ala Leu Ala Arg Phe Leu His Gln Glu  
 745 1750 1755 1760  
 Leu Ala Gly Glu Val Ala Ser Thr Ser Thr Pro Val Thr Arg Ala Ala  
 1765 1770 1775  
 Ser Ala Glu Glu Asp Leu Val Ala Ile Val Gly Met Gly Cys Arg Phe  
 1780 1785 1790  
 Pro Gly Gly Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala Gly  
 1795 1800 1805  
 Gly Val Asp Ala Val Ala Gly Phe Pro Asp Asp Arg Gly Trp Asp Leu  
 1810 1815 1820  
 Ala Ala Leu Tyr Asp Pro Asp Pro Asp Arg Leu Gly Thr Ser Tyr Val  
 825 1830 1835 1840  
 Cys Glu Gly Gly Phe Leu Arg Asp Ala Ala Glu Phe Asp Ala Asp Met  
 1845 1850 1855  
 Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg  
 1860 1865 1870  
 Leu Leu Leu Glu Val Ala Trp Glu Thr Leu Glu Arg Ala Gly Ile Asp  
 1875 1880 1885  
 Pro Phe Ser Leu His Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met  
 1890 1895 1900  
 Tyr His Asp Tyr Gly Ala Arg Phe Ile Thr Arg Ala Pro Glu Gly Phe  
 905 1910 1915 1920  
 Glu Gly His Leu Gly Thr Gly Asn Ala Gly Ser Val Leu Ser Gly Arg  
 1925 1930 1935  
 Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr  
 1940 1945 1950

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Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ala Leu  
1955 1960 1965  
Arg Ala Gly Glu Cys Glu Phe Ala Leu Ala Gly Gly Val Thr Val Met  
1970 1975 1980  
Ser Thr Pro Thr Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala  
985 1990 1995 2000  
Pro Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala Asp Gly Thr Gly  
2005 2010 2015  
Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala  
2020 2025 2030  
Arg Arg Asn Gly His Glu Val Leu Ala Val Val Arg Gly Ser Ala Val  
2035 2040 2045  
Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser  
2050 2055 2060  
Gln Gln Arg Val Ile Thr Gln Ala Leu Thr Ser Ala Gly Leu Ser Val  
065 2070 2075 2080  
Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly  
2085 2090 2095  
Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg  
2100 2105 2110  
Asp Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly  
2115 2120 2125  
His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met  
2130 2135 2140  
Ala Met Arg Gln Gly Glu Leu Pro Arg Thr Leu His Val Asp Glu Pro  
145 2150 2155 2160  
Ser Ala Gln Val Asp Trp Ser Ala Gly Thr Val Gln Leu Leu Thr Glu  
2165 2170 2175  
Asn Thr Pro Trp Pro Asp Ser Gly Arg Leu Arg Arg Ala Gly Val Ser  
2180 2185 2190  
Ser Phe Gly Ile Ser Gly Thr Asn Ala His Leu Ile Leu Glu Gln Pro  
2195 2200 2205  
Pro Arg Glu Ser Gln Arg Ser Thr Glu Pro Asp Ser Gly Ser Val Arg  
2210 2215 2220  
Asp Phe Pro Val Val Pro Trp Met Val Ser Gly Lys Thr Pro Glu Ala  
225 2230 2235 2240  
Leu Ser Ala Gln Ala Asp Ala Leu Met Ser Tyr Leu Ser Asn Arg Val  
2245 2250 2255  
Asp Ala Ser Pro Arg Asp Ile Gly Tyr Ser Leu Ala Val Thr Arg Pro  
2260 2265 2270  
Ala Leu Asp His Arg Ala Val Val Leu Gly Ala Asp Arg Ala Ala Leu  
2275 2280 2285

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Leu Pro Gly Leu Lys Ala Leu Ala Val Ser Asn Asp Ala Ala Glu Val  
 2290 2295 2300  
 Ile Thr Gly Thr Arg Ala Ala Gly Pro Val Gly Phe Val Phe Ser Gly  
 305 2310 2315 2320  
 Gln Gly Gly Gln Trp Pro Gly Met Gly Ser Gly Leu His Ser Ala Phe  
 2325 2330 2335  
 Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Cys Glu Leu Asp Ala  
 2340 2345 2350  
 His Leu Gly Gln Met Ala Arg Leu Arg Asp Val Leu Ser Gly Ser Asp  
 2355 2360 2365  
 Thr Gln Leu Leu Asp Gln Thr Leu Trp Ala Gln Pro Gly Leu Phe Ala  
 2370 2375 2380  
 Leu Gln Val Gly Leu Trp Glu Leu Leu Gly Ser Trp Gly Val Arg Pro  
 385 2390 2395 2400  
 Ala Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe Ala  
 2405 2410 2415  
 Ala Gly Val Leu Ser Leu Arg Asp Ala Ala Arg Leu Val Ala Gly Arg  
 2420 2425 2430  
 Ala Arg Leu Met Gln Ala Leu Pro Thr Gly Gly Ala Met Leu Ala Ala  
 2435 2440 2445  
 Ala Ala Gly Glu Glu Gln Leu Arg Pro Leu Leu Ala Asp Cys Gly Asp  
 2450 2455 2460  
 Arg Val Gly Ile Ala Ala Val Asn Ala Pro Gly Ser Val Val Leu Ser  
 465 2470 2475 2480  
 Gly Asp Arg Asp Val Leu Asp Asp Ile Ala Gly Arg Leu Asp Gly Gln  
 2485 2490 2495  
 Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser His  
 2500 2505 2510  
 Arg Met Asp Pro Met Leu Ala Glu Phe Thr Glu Ile Ala Arg Ser Val  
 2515 2520 2525  
 Asp Tyr Arg Ser Ser Gly Leu Pro Ile Val Ser Thr Leu Thr Gly Glu  
 2530 2535 2540  
 Leu Asp Glu Val Gly Met Pro Ala Thr Pro Glu Tyr Trp Val Arg Gln  
 545 2550 2555 2560  
 Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Ala Ala Leu Ala Ala  
 2565 2570 2575  
 His Gly Val Ser Thr Val Val Glu Val Gly Pro Asp Gly Val Leu Ser  
 2580 2585 2590  
 Ala Leu Val Gln Glu Cys Ala Ala Gly Ser Asp Gln Gly Gly Arg Val  
 2595 2600 2605  
 Ala Ala Val Pro Leu Met Arg Ser Asn Arg Asp Glu Ala His Thr Val  
 2610 2615 2620



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Thr Thr Ala Leu Ala Gln Ile His Val Arg Gly Ala Glu Val Asp Trp  
 625 2630 2635 2640  
 Arg Ser Phe Phe Ala Gly Thr Gly Ala Lys Gln Val Glu Leu Pro Thr  
 2645 2650 2655  
 Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Asp Ser Pro Ser Glu Pro  
 2660 2665 2670  
 Val Gly Gln Ser Ala Asp Pro Ala Arg Gln Ser Gly Phe Trp Glu Leu  
 2675 2680 2685  
 Val Glu Gln Glu Asp Val Ser Ala Leu Ser Ala Ala Leu His Ile Thr  
 2690 2695 2700  
 Gly Asp His Asp Val Gln Ala Ser Leu Glu Ser Val Val Pro Val Leu  
 705 2710 2715 2720  
 Ser Ser Trp His Arg Arg Ile Arg Asn Glu Ser Leu Val His Gln Trp  
 2725 2730 2735  
 Arg Tyr Arg Ile Ser Trp His Glu Arg Ala Asp Leu Pro Asp Pro Ser  
 2740 2745 2750  
 Leu Ser Gly Thr Trp Leu Val Val Val Pro Glu Gly Trp Ser Ala Ser  
 2755 2760 2765  
 Arg Gln Val Leu Arg Phe Asn Glu Met Phe Glu Glu Arg Gly Cys Pro  
 2770 2775 2780  
 Ala Val Leu Phe Glu Leu Ala Gly His Asp Glu Glu Ala Leu Ala Gln  
 785 2790 2795 2800  
 Arg Phe Arg Ser Leu Pro Val Ala Ser Gly Gly Ile Ser Gly Val Leu  
 2805 2810 2815  
 Ser Leu Leu Ala Leu Asp Glu Ser Pro Ser Ser Pro Asn Ala Ala Leu  
 2820 2825 2830  
 Pro Asn Gly Ala Leu Asn Ser Leu Val Leu Leu Arg Ala Leu Arg Ala  
 2835 2840 2845  
 Ala Asp Val Ser Ala Pro Leu Trp Leu Ala Thr Cys Gly Gly Val Ala  
 2850 2855 2860  
 Val Gly Asp Val Pro Val Asn Pro Gly Gln Ala Leu Val Trp Gly Leu  
 865 2870 2875 2880  
 Gly Arg Val Val Gly Leu Glu His Pro Ala Trp Trp Gly Gly Leu Val  
 2885 2890 2895  
 Asp Val Pro Cys Leu Leu Asp Glu Asp Ala Arg Glu Arg Leu Ser Val  
 2900 2905 2910  
 Val Leu Ala Gly Leu Gly Glu Asp Glu Ile Ala Val Arg Pro Gly Gly  
 2915 2920 2925  
 Val Phe Val Arg Arg Leu Glu Arg Ala Gly Ala Ala Ser Gly Ala Gly  
 2930 2935 2940  
 Ser Val Trp Arg Pro Arg Gly Thr Val Leu Val Thr Gly Gly Thr Gly  
 945 2950 2955 2960

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Gly Leu Gly Ala His Val Ala Arg Trp Leu Ala Gly Ala Gly Ala Glu  
2965 2970 2975  
His Val Val Leu Thr Ser Arg Arg Gly Ala Ala Ala Pro Gly Ala Gly  
2980 2985 2990  
Asp Leu Arg Ala Glu Leu Glu Ala Leu Gly Ala Arg Val Ser Ile Thr  
2995 3000 3005  
Ala Cys Asp Val Ala Asp Arg Asp Ala Leu Ala Glu Val Leu Ala Thr  
3010 3015 3020  
Ile Pro Asp Asp Cys Pro Leu Thr Ala Val Met His Ala Ala Gly Val  
025 3030 3035 3040  
Val Glu Val Gly Asp Val Ala Ser Met Cys Leu Thr Asp Phe Val Gly  
3045 3050 3055  
Val Leu Ser Ala Lys Ala Gly Gly Ala Ala Asn Leu Asp Glu Leu Leu  
3060 3065 3070  
Ala Asp Val Glu Leu Asp Ala Phe Val Leu Phe Ser Ser Val Ser Gly  
3075 3080 3085  
Val Trp Gly Ala Gly Gly Gln Gly Ala Tyr Ala Ala Ala Asn Ala Tyr  
3090 3095 3100  
Leu Asp Ala Leu Ala Gln Gln Arg Arg Ala Arg Gly Leu Val Gly Thr  
105 3110 3115 3120  
Ala Val Ala Trp Gly Pro Trp Ala Gly Asp Gly Met Ala Ala Gly Glu  
3125 3130 3135  
Gly Gly Ala Gln Leu Arg Arg Ala Gly Leu Val Pro Met Ala Ala Asp  
3140 3145 3150  
Arg Ala Leu Leu Ala Leu Gln Gly Ala Leu Asp Arg Asp Glu Thr Ser  
3155 3160 3165  
Leu Val Val Ala Asp Met Ala Trp Glu Arg Phe Ala Pro Val Phe Ala  
3170 3175 3180  
Met Ser Arg Arg Arg Pro Leu Leu Asp Glu Leu Pro Glu Ala Gln Gln  
185 3190 3195 3200  
Ala Leu Ala Asp Ala Glu Asn Thr Thr Asp Ala Ala Asp Ser Ala Val  
3205 3210 3215  
Pro Leu Pro Arg Leu Ala Gly Met Ala Ala Ala Glu Arg Arg Arg Ala  
3220 3225 3230  
Met Leu Asp Leu Val Leu Ala Glu Ala Ser Ile Val Leu Gly His Asn  
3235 3240 3245  
Gly Ser Asp Pro Val Gly Pro Asp Arg Ala Phe Gln Glu Leu Gly Phe  
3250 3255 3260  
Asp Ser Leu Met Ala Val Glu Leu Arg Asn Arg Leu Gly Glu Ala Thr  
265 3270 3275 3280  
Gly Leu Ser Leu Pro Ala Thr Leu Ile Phe Asp Tyr Pro Ser Pro Ser  
3285 3290 3295

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Ala Leu Ala Glu Gln Leu Val Gly Glu Leu Val Gly Ala Gln Pro Ala  
3300 3305 3310

Thr Thr Val Val Ala Gly Ala Asp Pro Val Asp Asp Pro Val Val Val  
3315 3320 3325

Val Ala Met Gly Cys Arg Tyr Pro Gly Asp Val Cys Ser Pro Glu Glu  
3330 3335 3340

Leu Trp Gln Leu Val Ser Ala Gly Arg Asp Ala Val Ser Thr Phe Pro  
3345 3350 3355 3360

Val Asp Arg Gly Trp Asp Cys Asn Thr Leu Phe Asp Pro Asp Pro Asp  
3365 3370 3375

Arg Ala Gly Ser Thr Tyr Val Arg Glu Gly Ala Phe Leu Thr Gly Ala  
3380 3385 3390

Asp Arg Phe Asp Ala Gly Phe Phe Gly Ile Ser Pro Arg Glu Ala Arg  
3395 3400 3405

Ala Met Asp Pro Gln Gln Arg Leu Leu Leu Glu Val Ala Trp Glu Val  
3410 3415 3420

Phe Glu Arg Ala Gly Ile Ala Pro Leu Ser Leu Arg Gly Ser Arg Thr  
3425 3430 3435 3440

Gly Val Phe Ala Gly Thr Asn Gly Gln Asp His Gly Ala Lys Val Ala  
3445 3450 3455

Ala Ala Pro Glu Ala Ala Gly His Leu Leu Thr Gly Asn Ala Ala Ser  
3460 3465 3470

Val Leu Ala Gly Arg Leu Ser Tyr Thr Phe Gly Leu Glu Gly Pro Ala  
3475 3480 3485

Val Ala Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu  
3490 3495 3500

Ala Cys Gln Ser Leu Arg Ser Gly Glu Cys Asp Met Ala Leu Ala Gly  
3505 3510 3515 3520

Gly Val Thr Val Met Ser Thr Pro Leu Ala Phe Leu Glu Phe Ser Arg  
3525 3530 3535

Gln Arg Gly Leu Ala Pro Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala  
3540 3545 3550

Ala Asp Gly Thr Gly Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu  
3555 3560 3565

Arg Leu Ser Asp Ala Arg Arg Asn Gly His Arg Val Leu Ala Val Val  
3570 3575 3580

Arg Gly Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala  
3585 3590 3595 3600

Pro Asn Gly Pro Ser Gln Gln Arg Val Ile Arg Gln Ala Leu Ala Asn  
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Ala Gly Leu Ser Ala Ser Asp Val Asp Val Val Glu Ala His Gly Thr  
3620 3625 3630

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Gly Thr Gly Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr  
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Tyr Gly Gln Glu Arg Asp Pro Glu Arg Ala Leu Trp Leu Gly Ser Ile  
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Lys Ser Asn Ile Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val  
665 3670 3675 3680

Ile Lys Met Val Gln Ala Met Arg His Gly Glu Leu Pro Ala Thr Leu  
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His Val Asp Lys Pro Thr Pro Gln Val Asp Trp Ser Ala Gly Ala Val  
3700 3705 3710

Arg Leu Leu Thr Gly Asn Thr Pro Trp Pro Glu Ser Gly Arg Pro Arg  
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Arg Ala Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Leu  
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Ile Leu Glu Gln Pro Pro Ser Glu Pro Ala Glu Ile Asp Gln Ser Asp  
745 3750 3755 3760

Arg Arg Val Thr Ala His Pro Ala Val Ile Pro Trp Met Leu Ser Ala  
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Arg Ser Leu Ala Ala Leu Gln Ala Gln Ala Ala Ala Leu Gln Ala Arg  
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Leu Asp Arg Gly Pro Gly Ala Ser Pro Leu Asp Leu Gly Tyr Ser Leu  
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Ala Thr Thr Arg Ser Val Leu Asp Glu Arg Ala Val Val Trp Gly Ala  
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Asp Arg Glu Ala Leu Leu Ser Arg Leu Ala Ala Leu Ala Asp Gly Arg  
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Thr Ala Pro Gly Val Ile Thr Gly Ser Ala Asn Ser Gly Gly Arg Ile  
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Gly Phe Val Phe Ser Gly Gln Gly Ser Gln Trp Leu Gly Met Gly Lys  
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Ala Leu Cys Ala Ala Phe Pro Ala Phe Ala Asp Ala Phe Glu Glu Ala  
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Cys Asp Ala Leu Ser Ala His Leu Gly Ala Asp Val Arg Gly Val Leu  
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Phe Gly Ala Asp Glu Gln Met Leu Asp Arg Thr Leu Trp Ala Gln Ser  
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Gly Ile Phe Ala Val Gln Val Gly Leu Leu Gly Leu Leu Arg Ser Trp  
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Gly Val Arg Pro Ala Ala Val Leu Gly His Ser Val Gly Glu Leu Ala  
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Ala Ala His Ala Ala Gly Val Leu Ser Leu Pro Asp Ala Ala Arg Leu  
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Val Ala Ala Arg Ala His Leu Met Gln Ala Leu Pro Thr Gly Gly Ala  
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Met Leu Ala Val Ala Thr Ser Glu Ala Ala Val Gly Pro Leu Leu Ser  
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Gly Val Cys Asp Arg Val Ser Ile Ala Ala Ile Asn Gly Pro Glu Ser  
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Val Val Leu Ser Gly Asp Arg Asp Val Leu Val Glu Leu Ala Gly Glu  
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Phe Asp Ala Arg Gly Leu Arg Thr Lys Trp Leu Arg Val Ser His Ala  
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Phe His Ser His Arg Met Glu Pro Ile Leu Asp Glu Tyr Ala Glu Thr  
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Ala Arg Cys Val Glu Phe Gly Glu Pro Val Val Pro Ile Val Ser Ala  
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Ala Thr Gly Ala Leu Asp Thr Thr Gly Leu Met Cys Ala Ala Asp Tyr  
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Trp Thr Arg Gln Val Arg Asp Pro Val Arg Phe Gly Asp Gly Val Arg  
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Gly Ala Leu Ser Ala Leu Val Glu Gln Cys Leu Ala Gly Ser Asp Gln  
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Val Glu Thr Ala Val Ala Ala Leu Ala His Val His Val Arg Gly Gly  
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Ala Val Asp Trp Ser Ala Cys Phe Ala Gly Thr Gly Ala Arg Thr Val  
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Glu Leu Pro Thr Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Ala Gly  
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Gln Ala Asp Gly Arg Gly Gly Asp Val Val Ala Asp Pro Val Asp Ala  
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Arg Phe Trp Glu Leu Val Glu Arg Ala Asp Pro Glu Pro Leu Val Asp  
4225 4230 4235 4240

Glu Leu Cys Ile Asp Arg Asp Gln Pro Phe Arg Glu Val Leu Pro Val  
4245 4250 4255

Leu Ala Ser Trp Arg Glu Lys Gln Arg Gln Glu Ala Leu Ala Asp Ser  
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Trp Arg Tyr Gln Val Arg Trp Arg Ser Val Glu Val Pro Ser Ala Ala  
4275 4280 4285

Ala Leu Arg Gly Val Trp Leu Val Val Leu Pro Ala Asp Val Pro Arg  
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Asp Gln Pro Ala Val Val Ile Asp Ala Leu Ile Ala Arg Gly Ala Glu  
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 Val Ala Val Leu Glu Leu Thr Glu Gln Asp Leu Gln Arg Ser Ala Leu  
 4325 4330 4335  
 Val Asp Lys Val Arg Ala Val Ile Ala Asp Arg Thr Glu Val Thr Gly  
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 Val Leu Ser Leu Leu Ala Met Asp Gly Met Pro Cys Ala Ala His Pro  
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 His Leu Ser Arg Gly Val Ala Ala Thr Val Ile Leu Thr Gln Val Leu  
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 Gly Asp Ala Gly Val Ser Ala Pro Leu Trp Leu Ala Thr Thr Gly Gly  
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 Val Glu Ala Gly Thr Glu Asp Gly Pro Ala Asp Pro Asp His Gly Leu  
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 Ile Trp Gly Leu Gly Arg Val Val Gly Leu Glu His Pro Gln Trp Trp  
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 Gly Gly Leu Ile Asp Leu Pro Glu Thr Leu Asp Glu Thr Ser Arg Asn  
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 Gly Leu Val Ala Ala Leu Ala Gly Thr Ala Ala Glu Asp Gln Leu Ala  
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 Val Arg Ser Ser Gly Leu Phe Val Arg Arg Val Val Arg Ala Ala Arg  
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 Thr Ala Gly Val Gly Thr Pro Ala Asn Leu Ala Glu Thr Thr Leu Ala  
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 Gln Phe Ala Asp Val Leu Ser Ala Lys Val Val Gly Ala Ala Asn Leu  
 4595 4600 4605  
 Asp Arg Leu Leu Gly Gly Gln Pro Leu Asp Ala Phe Val Leu Phe Ser  
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 Ser Ile Ser Gly Val Trp Gly Ala Gly Gly Gln Gly Ala Tyr Ser Ala  
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Ala Asn Ala Tyr Leu Asp Ala Leu Ala Glu Arg Arg Arg Ala Cys Gly  
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Arg Pro Ala Thr Cys Ile Ala Trp Gly Pro Trp Ala Gly Ala Gly Met  
4660 4665 4670

Ala Val Gln Glu Gly Asn Glu Ala His Leu Arg Arg Arg Gly Leu Val  
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Pro Met Glu Pro Gln Ser Ala Leu Phe Ala Leu Gln Gln Ala Leu Ser  
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Gln Arg Glu Thr Ala Ile Thr Val Ala Asp Val Asp Trp Glu Arg Phe  
705 4710 4715 4720

Ala Ala Ser Phe Thr Ala Ala Arg Pro Arg Pro Leu Leu Glu Glu Ile  
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Val Asp Leu Arg Pro Asp Thr Glu Thr Glu Glu Lys His Gly Ala Gly  
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Glu Leu Gly Gln Gln Leu Ala Ala Leu Pro Pro Ala Glu Arg Gly His  
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Leu Leu Leu Glu Val Val Leu Ala Glu Thr Ala Ser Thr Leu Gly His  
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Asp Ser Ala Glu Ala Val Gln Pro Asp Arg Thr Phe Ala Glu Leu Gly  
785 4790 4795 4800

Phe Asp Ser Leu Thr Ala Val Glu Leu Arg Asn Arg Leu Asn Ala Val  
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Thr Gly Leu Arg Leu Pro Pro Thr Leu Val Phe Asp His Pro Thr Pro  
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Leu Ala Leu Ser Glu Gln Leu Val Pro Ala Leu Val Ala Glu Pro Asp  
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Asn Gly Ile Glu Ser Leu Leu Ala Glu Leu Asp Arg Leu Asp Thr Thr  
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Leu Ala Gln Gly Pro Ser Ile Pro Leu Glu Asp Gln Ala Lys Val Ala  
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Glu Arg Leu His Ala Leu Leu Ala Lys Trp Asp Gly Ala Arg Asp Gly  
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Glu Leu Glu Glu Ala His Glu Arg Leu His Glu Leu Glu Arg Gln Glu	
20 25 30	
cac gac ccc atc gcg atc gtg tgc atg gga tgt cgt tat ccc ggt ggc	144
His Asp Pro Ile Ala Ile Val Ser Met Gly Cys Arg Tyr Pro Gly Gly	
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gtc tcc act ccg gag gag ctg tgg cga ctg gtc gtc gac gga gga gac	192
Val Ser Thr Pro Glu Glu Leu Trp Arg Leu Val Val Asp Gly Gly Asp	
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gcg atc gcg aac ttc ccc gaa gac cgt ggc tgg aat ctg gac gag ctg	240
Ala Ile Ala Asn Phe Pro Glu Asp Arg Gly Trp Asn Leu Asp Glu Leu	
65 70 75 80	
ttc gat cct gat ccg ggc cga gcc ggg acc tcc tac gtc cgc gag ggt	288
Phe Asp Pro Asp Pro Gly Arg Ala Gly Thr Ser Tyr Val Arg Glu Gly	
85 90 95	
ggt ttc ctg cgc ggg gtc gcg gac ttc gat gcc ggg ctg ttc ggg atc	336
Gly Phe Leu Arg Gly Val Ala Asp Phe Asp Ala Gly Leu Phe Gly Ile	
100 105 110	
agt ccg cgc gag gca cag gcg atg gac ccg caa cag cgg ttg ctg ctg	384
Ser Pro Arg Glu Ala Gln Ala Met Asp Pro Gln Gln Arg Leu Leu Leu	
115 120 125	
gag atc tcg tgg gag gtg ttc gag cgc gcc ggc att gac ccg ttt tct	432
Glu Ile Ser Trp Glu Val Phe Glu Arg Ala Gly Ile Asp Pro Phe Ser	
130 135 140	
ttg cgg ggt acc aag acc ggt gtg ttc gcg ggc ctg atc tac cac gac	480
Leu Arg Gly Thr Lys Thr Gly Val Phe Ala Gly Leu Ile Tyr His Asp	
145 150 155 160	
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Tyr Ala Ser Arg Phe Arg Lys Thr Pro Ala Glu Phe Glu Gly Tyr Phe	
165 170 175	
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Ala Thr Gly Asn Ala Gly Ser Val Ala Ser Gly Arg Val Ala Tyr Thr	
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ttc ggg tta gag ggc ccg gcg gtc acc gtg gac acc gcc tgc tcg tcg	624
Phe Gly Leu Glu Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser	
195 200 205	
tcc ctg gtg gcg ctg cac ctg gcc tgc cag tcc ctg cgg ctg ggc gaa	672
Ser Leu Val Ala Leu His Leu Ala Cys Gln Ser Leu Arg Leu Gly Glu	
210 215 220	
tgc gac ctg gcc ctg gcc ggt ggc att tcg gtg atg gcc acg ccg gga	720
Cys Asp Leu Ala Leu Ala Gly Gly Ile Ser Val Met Ala Thr Pro Gly	
225 230 235 240	



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tgc Cys	aag Lys	ccc Pro	ttc Phe 260	gcg Ala	gat Asp	gcc Ala	gcc Ala	gac Asp 265	ggc Gly	acc Thr	ggc Gly	tgg Trp	ggc Gly 270	gag Glu	ggc Gly	816
gcc Ala	gga Gly	atg Met 275	ctg Leu	ctg Leu	ctg Leu	gaa Glu	cgg Arg 280	ctg Leu	tcg Ser	gac Asp	gca Ala	cga Arg 285	cga Arg	aac Asn	ggc Gly	864
cac His	ccg Pro 290	gtg Val	ctg Leu	gcg Ala	gcg Ala	gtg Val 295	gtc Val	ggg Gly	tcc Ser	gcg Ala	atc Ile 300	aac Asn	cag Gln	gac Asp	ggg Gly	912
acg Thr 305	tcc Ser	aac Asn	ggc Gly	ctg Leu	acc Thr 310	gcg Ala	ccc Pro	agc Ser	ggg Gly 315	ccc Pro	gca Ala	cag Gln	cag Gln	cga Arg	gtg Val 320	960
atc Ile	cgc Arg	caa Gln	gcc Ala	ctg Leu 325	gcg Ala	aac Asn	gcc Ala	ggg Gly	ttg Leu 330	tcg Ser	ccc Pro	gcc Ala	gag Glu	gtc Val 335	gat Asp	1008
gtg Val	gtc Val	gag Glu	gcg Ala 340	cac His	ggc Gly	acg Thr	ggc Gly	acg Thr 345	gcc Ala	ttg Leu	ggc Gly	gac Asp	ccg Pro 350	atc Ile	gag Glu	1056
gcg Ala	cag Gln	gcc Ala 355	ctg Leu	atc Ile	gcc Ala	acc Thr	tac Tyr 360	ggg Gly	gcg Ala	aac Asn	cgg Arg 365	tcg Ser 365	gcg Ala	gat Asp	cat His	1104
ccg Pro 370	ctg Leu	ctg Leu	ctg Leu	ggg Gly	tcc Ser	ctc Leu 375	aag Lys	tcg Ser	aac Asn	atc Ile	ggc Gly 380	cac His	acc Thr	cag Gln	gct Ala	1152
gcc Ala 385	gcc Ala	ggg Gly	gtg Val	gcc Ala	ggg Gly 390	gtg Val	atc Ile	aag Lys	tcg Ser	gtc Val 395	ctg Leu	gcc Ala	atc Ile	agg Arg	cac His 400	1200
cgg Arg	gag Glu	atg Met	ccc Pro	cgc Arg 405	agc Ser	ctg Leu	cac His	atc Ile	gac Asp 410	cag Gln	cca Pro	tcg Ser	cag Gln	cac His 415	gtg Val	1248
gac Asp	tgg Trp	tcg Ser	gcg Ala 420	ggc Gly	gcg Ala	gtg Val	cgg Arg	ctg Leu 425	ctc Leu	acg Thr	gac Asp	agc Ser	gtt Val 430	gac Asp	tgg Trp	1296
ccg Pro	gat Asp	ctc Leu 435	ggc Gly	agg Arg	ccg Pro	cgc Arg	cga Arg 440	gca Ala	ggg Gly	gtg Val	tcc Ser	tcg Ser 445	ttc Phe	ggc Gly	atg Met	1344
agc Ser	ggg Gly 450	acc Thr	aac Asn	gca Ala	cac His	ctg Leu 455	atc Ile	gtc Val	gag Glu	gaa Glu	gta Val 460	tcc Ser	gac Asp	gag Glu	ccg Pro	1392
gtc Val 465	tcg Ser	ggc Gly	agt Ser	acc Thr	gag Glu 470	ccg Pro	acc Thr	ggg Gly	gca Ala	ttt Phe 475	ccc Pro	tgg Trp	ccg Pro	ctg Leu	tcc Ser 480	1440
ggc Gly	aag Lys	acg Thr	gag Glu	acg Thr	gca Ala	ttg Leu	cgc Arg	gag Glu	cag Gln	gct Ala	gcc Ala	gag Glu	ttg Leu	ctc Leu	tcc Ser	1488

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485								490				495			
gta	gtg	acc	gag	cac	ccg	gag	ccg	gga	ctg	ggg	gac	gtc	ggg	tac	tcg
Val	Val	Thr	Glu	His	Pro	Glu	Pro	Gly	Leu	Gly	Asp	Val	Gly	Tyr	Ser
			500					505					510		
ctg	gcc	acc	ggt	cgc	gct	gcg	atg	gag	cac	cgg	gct	gtc	gtg	gtt	gcc
Leu	Ala	Thr	Gly	Arg	Ala	Ala	Met	Glu	His	Arg	Ala	Val	Val	Val	Ala
		515					520					525			
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Asp	Asp	Arg	Asp	Ser	Phe	Val	Ala	Gly	Leu	Thr	Ala	Leu	Ala	Ala	Gly
	530					535					540				
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Val	Pro	Ala	Ala	Asn	Val	Val	Gln	Gly	Ala	Ala	Asp	Cys	Lys	Gly	Lys
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gtc	gcg	ttc	gtg	ttc	ccc	ggc	cag	ggc	tcg	cat	tgg	cag	ggg	atg	gcg
Val	Ala	Phe	Val	Phe	Pro	Gly	Gln	Gly	Ser	His	Trp	Gln	Gly	Met	Ala
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agg	gaa	ctg	tcc	gaa	tcc	tcg	ccg	gtg	ttc	cgg	cgg	aag	ctg	gcg	gaa
Arg	Glu	Leu	Ser	Glu	Ser	Ser	Pro	Val	Phe	Arg	Arg	Lys	Leu	Ala	Glu
			580					585					590		
tgc	gcg	gcg	gct	acg	gcc	cct	tac	gtg	gac	tgg	tcg	ctg	ctc	ggc	gtc
Cys	Ala	Ala	Ala	Thr	Ala	Pro	Tyr	Val	Asp	Trp	Ser	Leu	Leu	Gly	Val
		595					600					605			
ctt	cgc	ggt	gat	ccc	gat	gca	ccc	gcg	ctg	gat	cgc	gac	gac	gtg	att
Leu	Arg	Gly	Asp	Pro	Asp	Ala	Pro	Ala	Leu	Asp	Arg	Asp	Asp	Val	Ile
	610					615					620				
cag	ctc	gcg	ctg	ttc	gcc	atg	atg	gtg	tcg	ctg	gcc	gaa	ctg	tgg	cgt
Gln	Leu	Ala	Leu	Phe	Ala	Met	Met	Val	Ser	Leu	Ala	Glu	Leu	Trp	Arg
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Ser	Cys	Gly	Val	Glu	Pro	Ala	Ala	Val	Val	Gly	His	Ser	Gln	Gly	Glu
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atc	gcc	gcc	gcc	cat	gtg	gca	ggc	gct	ttg	tcc	ttg	act	gat	gcg	gtg
Ile	Ala	Ala	Ala	His	Val	Ala	Gly	Ala	Leu	Ser	Leu	Thr	Asp	Ala	Val
			660					665					670		
cgc	atc	atc	gct	gcc	cgc	tgc	gat	gcg	gtg	tcg	gcg	ctg	acc	ggg	aag
Arg	Ile	Ile	Ala	Ala	Arg	Cys	Asp	Ala	Val	Ser	Ala	Leu	Thr	Gly	Lys
		675					680					685			
gga	ggc	atg	ctc	gcg	att	gcc	ttg	ccg	gaa	agc	gcg	gtg	gtg	aag	cga
Gly	Gly	Met	Leu	Ala	Ile	Ala	Leu	Pro	Glu	Ser	Ala	Val	Val	Lys	Arg
	690					695					700				
atc	gca	ggc	ctg	ccg	gag	ctg	acc	gtt	gcg	gcg	gtc	aac	gga	ccc	ggc
Ile	Ala	Gly	Leu	Pro	Glu	Leu	Thr	Val	Ala	Ala	Val	Asn	Gly	Pro	Gly
705					710				715						720
tcc	act	gtc	gtt	tcc	ggc	gaa	ccg	tcg	gct	ctg	gag	cgt	ctg	cag	acc
Ser	Thr	Val	Val	Ser	Gly	Glu	Pro	Ser	Ala	Leu	Glu	Arg	Leu	Gln	Thr
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gaa	ctg	acc	gcg	gaa	aac	gtg	cag	acc	cgg	cgg	gtg	gga	att	gat	tac

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Glu	Leu	Thr	Ala	Glu	Asn	Val	Gln	Thr	Arg	Arg	Val	Gly	Ile	Asp	Tyr
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Ala	Ser	His	Ser	Pro	Gln	Ile	Ala	Gln	Val	Gln	Gly	Arg	Leu	Leu	Asp
		755					760				765				2304
cgg	ctg	ggc	gaa	gtc	ggg	tcc	gaa	cct	gct	gag	atc	gct	ttc	tac	tcg
Arg	Leu	Gly	Glu	Val	Gly	Ser	Glu	Pro	Ala	Glu	Ile	Ala	Phe	Tyr	Ser
	770					775					780				2352
acg	gtc	acc	ggc	gag	cgg	acg	gac	acc	ggc	cga	ctc	gac	gcc	gac	tac
Thr	Val	Thr	Gly	Glu	Arg	Thr	Asp	Thr	Gly	Arg	Leu	Asp	Ala	Asp	Tyr
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Trp	Tyr	Gln	Asn	Leu	Arg	Gln	Pro	Val	Arg	Phe	Gln	Gln	Thr	Val	Ala
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cgg	atg	gca	gat	cag	ggc	tat	cgg	ttc	ttc	gtc	gag	gtg	agc	ccg	cac
Arg	Met	Ala	Asp	Gln	Gly	Tyr	Arg	Phe	Phe	Val	Glu	Val	Ser	Pro	His
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ccg	ctg	ctc	acc	gcc	gga	atc	cag	gaa	acg	ctg	gaa	gcc	gcg	gac	gcg
Pro	Leu	Leu	Thr	Ala	Gly	Ile	Gln	Glu	Thr	Leu	Glu	Ala	Ala	Asp	Ala
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Gly	Gly	Val	Val	Val	Gly	Ser	Leu	Arg	Arg	Gly	Glu	Gly	Gly	Ser	Arg
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Arg	Trp	Leu	Thr	Ser	Leu	Ala	Glu	Cys	Gln	Val	Arg	Gly	Leu	Pro	Val
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Pro	Thr	Tyr	Pro	Phe	Gln	Arg	Gln	Arg	Tyr	Trp	Leu	Glu	Ser	Ala	Glu
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Tyr	Asp	Ala	Gly	Asp	Leu	Gly	Ser	Val	Gly	Leu	Leu	Ser	Ala	Glu	His
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Pro	Leu	Leu	Gly	Ala	Ala	Val	Thr	Leu	Ala	Asp	Ala	Gly	Gly	Phe	Leu
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Val	Val	Gly	Gly	Ala	Ile	Leu	Leu	Pro	Gly	Thr	Ala	Phe	Val	Glu	Met
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ctg	ata	cgc	gcc	gcg	gac	cag	gtc	ggg	tgc	gat	ctg	atc	gag	gag	ttg
Leu	Ile	Arg	Ala	Ala	Asp	Gln	Val	Gly	Cys	Asp	Leu	Ile	Glu	Glu	Leu
			980					985					990		
															2976

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gtg cat tcc tgt cga gac gac gcc gtg ccg cag gac tcg tgg acc tgc Val His Ser Cys Arg Asp Asp Ala Val Pro Gln Asp Ser Trp Thr Cys 1025 1030 1035 1040	3120
cac gcg acc ggc acg ttg acc tcc agc gat cac cag gac gcc ggc cag His Ala Thr Gly 1045 Leu Thr Ser Ser Asp 1050 His Gln Asp Ala Gly 1055	3168
ggc ccc gat ggg att tgg ccg ccc aac gat gct gtc gcg gtt ccg ctg Gly Pro Asp Gly 1060 Ile Trp Pro Pro Asn Asp Ala Val Ala Val Pro Leu 1070	3216
gac agc ttc tac gcc cgc gca gct gag cgg ggc ttc gat ttc ggc ccg Asp Ser Phe Tyr Ala Arg Ala Ala Glu Arg Gly Phe Asp Phe Gly Pro 1075 1080 1085	3264
gcg ttc cag ggg ttg cag gcg gct tgg aag cgc gga gac gag atc ttc Ala Phe Gln Gly Leu Gln Ala Ala Trp Lys Arg Gly Asp Glu Ile Phe 1090 1095 1100	3312
gcc gag gtc ggc ctg ccc acc gca cac cgc gaa gac gcc ggc agg ttc Ala Glu Val Gly Leu Pro Thr Ala His Arg Glu Asp Ala Gly Arg Phe 1105 1110 1115 1120	3360
gga atc cac cct gct ctg ctg gat gcg gca ctg cag gcg ctg ggc gca Gly Ile His Pro Ala Leu Leu Asp Ala Ala Leu Gln Ala Leu Gly Ala 1125 1130 1135	3408
gcc gaa gag gat ccg gac gag gga tgg ctc ccg ttc gcg tgg caa ggt Ala Glu Glu Asp Pro Asp Glu Gly Trp Leu Pro Phe Ala Trp Gln Gly 1140 1145 1150	3456
gtg tcc ctc aaa gcg acg ggc gca ctt tcc ctt cgg gtg cac ctc gtt Val Ser Leu Lys Ala Thr Gly Ala Leu Ser Leu Arg Val His Leu Val 1155 1160 1165	3504
ccg gcg ggc gcg aat gcg gtg tcg gtg ttc acg acc gac acg act ggc Pro Ala Gly Ala Asn Ala Val Ser Val Phe Thr Thr Asp Thr Thr Gly 1170 1175 1180	3552
caa gcc gtg ctc tcc atc gat tcg ctg gtg ctg cgc cag att tcg gac Gln Ala Val Leu Ser Ile Asp Ser Leu Val Leu Arg Gln Ile Ser Asp 1185 1190 1195 1200	3600
aag cag ttg gca gcg gcc cgt gcg atg gaa cac gag tcc ctg ttc cgg Lys Gln Leu Ala Ala Ala Arg Ala Met Glu His Glu Ser Leu Phe Arg 1205 1210 1215	3648
gtc gac tgg aag cga atc tcg ccc ggc gct gcc aag ccg gtc tcc tgg Val Asp Trp Lys Arg Ile Ser Pro Gly Ala Ala Lys Pro Val Ser Trp 1220 1225 1230	3696
gca gtg atc ggc aat gac gaa ctc gcc cga gcc tgc ggc tcg gca ctt Ala Val Ile Gly Asn Asp Glu Leu Ala Arg Ala Cys Gly Ser Ala Leu 1235 1240 1245	3744

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ggc acg gaa ctc cac ccc gac ctg acc ggg ttg gct gac ccg ccc ccg Gly Thr Glu Leu His Pro Asp Leu Thr Gly Leu Ala Asp Pro Pro Pro 1250 1255 1260	3792
gac gtc gtg gtg gtg cca tgc ggt gcg tct cgc cag gac ttg gac gtt Asp Val Val Val Val Pro Cys Gly Ala Ser Arg Gln Asp Leu Asp Val 1265 1270 1275 1280	3840
gct tcc gag gca cgt gcc gcg aca caa cgc atg ctt gac ctg atc cag Ala Ser Glu Ala Arg Ala Ala Thr Gln Arg Met Leu Asp Leu Ile Gln 1285 1290 1295	3888
gat tgg ttg gcg gcg gcg cga ttc gcc gga tct cgc ctg gtg gtt gtg Asp Trp Leu Ala Ala Ala Arg Phe Ala Gly Ser Arg Leu Val Val Val 1300 1305 1310	3936
acg tgt ggt gcg gcg tcg aca ggt ccc gcc gag ggt gtt tcc gac ctg Thr Cys Gly Ala Ala Ser Thr Gly Pro Ala Glu Gly Val Ser Asp Leu 1315 1320 1325	3984
gtg cat gct gcg tcg tgg ggt ttg ttg cgt tcg gcg cag tcg gag aac Val His Ala Ala Ser Trp Gly Leu Leu Arg Ser Ala Gln Ser Glu Asn 1330 1335 1340	4032
ccg gac cga ttc gtg ttg gtc gat gtg gac gga acc gcc gaa tca tgg Pro Asp Arg Phe Val Leu Val Asp Val Asp Gly Thr Ala Glu Ser Trp 1345 1350 1355 1360	4080
cgt gcg ctc gcg gcg gcc gtg cgt tcc gga gaa ccg cag ctg gcg ttg Arg Ala Leu Ala Ala Val Arg Ser Gly Glu Pro Gln Leu Ala Leu 1365 1370 1375	4128
cgc gcc ggt gaa gtc cgg gtg cct cgc ctg gcg cga tgt gtt gcc gcc Arg Ala Gly Glu Val Arg Val Pro Arg Leu Ala Arg Cys Val Ala Ala 1380 1385 1390	4176
gag gac agc cgg atc cca gtg ccc ggt gcg gat ggg acg gtg ttg att Glu Asp Ser Arg Ile Pro Val Pro Gly Ala Asp Gly Thr Val Leu Ile 1395 1400 1405	4224
tcc ggc ggt acg ggc ctg ctg ggc ggg ttg gtt gcc cgg cat ttg gtg Ser Gly Gly Thr Gly Leu Leu Gly Gly Leu Val Ala Arg His Leu Val 1410 1415 1420	4272
gcg gag cgc ggt gtc cgc cgc ctg gtg ctc gcg ggg cga cgc ggc tgg Ala Glu Arg Gly Val Arg Arg Leu Val Leu Ala Gly Arg Arg Gly Trp 1425 1430 1435 1440	4320
agc gcc ccc ggg gtc acc gac ctg gtg gat gag ttg gtg ggc ctg gga Ser Ala Pro Gly Val Thr Asp Leu Val Asp Glu Leu Val Gly Leu Gly 1445 1450 1455	4368
gct gcg gtc gag gtg gcg agc tgc gat gtc ggg gat cgg gcc cag ttg Ala Ala Val Glu Val Ala Ser Cys Asp Val Gly Asp Arg Ala Gln Leu 1460 1465 1470	4416
gac cgg ctg ctg acg acg atc tcg gca gag ttc ccg ctg cgc gga gtg Asp Arg Leu Leu Thr Thr Ile Ser Ala Glu Phe Pro Leu Arg Gly Val 1475 1480 1485	4464
gtg cat gcg gcc ggg gca ctt gcc gac ggg gtc gtc gag tcg ctg aca Val His Ala Ala Gly Ala Leu Ala Asp Gly Val Val Glu Ser Leu Thr 1490 1495 1500	4512

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1490				1495				1500								
cca	gag	cac	gtg	gca	aag	gtg	ttc	ggc	ccg	aag	gcc	gcc	ggt	gcg	tgg	4560
Pro	Glu	His	Val	Ala	Lys	Val	Phe	Gly	Pro	Lys	Ala	Ala	Gly	Ala	Trp	
1505					1510				1515					1520		
cac	ctg	cac	gag	ttg	act	ctt	gat	ctg	gat	ctc	tcg	ttc	ttc	gtg	ctc	4608
His	Leu	His	Glu	Leu	Thr	Leu	Asp	Leu	Asp	Leu	Ser	Phe	Phe	Val	Leu	
			1525					1530						1535		
ttc	tcc	tcg	ttc	tcc	ggc	gtg	gcg	ggg	gct	gcg	ggt	cag	gga	aac	tac	4656
Phe	Ser	Ser	Phe	Ser	Gly	Val	Ala	Gly	Ala	Ala	Gly	Gln	Gly	Asn	Tyr	
			1540					1545					1550			
gcg	gcg	gcg	aac	gcg	ttc	ctg	gac	ggc	ctg	gct	cag	cac	cgg	cgg	acg	4704
Ala	Ala	Ala	Asn	Ala	Phe	Leu	Asp	Gly	Leu	Ala	Gln	His	Arg	Arg	Thr	
			1555				1560					1565				
gcg	ggg	ctg	cct	gcg	gtg	tcg	ctg	gct	tgg	ggc	ttg	tgg	gag	cag	ccc	4752
Ala	Gly	Leu	Pro	Ala	Val	Ser	Leu	Ala	Trp	Gly	Leu	Trp	Glu	Gln	Pro	
	1570					1575					1580					
agc	ggg	atg	acc	gga	gcg	ctc	gat	gcg	gcg	ggc	cgt	agc	cgc	att	gcg	4800
Ser	Gly	Met	Thr	Gly	Ala	Leu	Asp	Ala	Ala	Gly	Arg	Ser	Arg	Ile	Ala	
1585					1590					1595					1600	
cgc	acc	aat	ccg	ccg	atg	tcc	gcg	ccg	gac	ggg	ttg	cgg	ctg	ttc	gag	4848
Arg	Thr	Asn	Pro	Pro	Met	Ser	Ala	Pro	Asp	Gly	Leu	Arg	Leu	Phe	Glu	
			1605						1610					1615		
atg	gcg	ttt	cgc	gtt	ccg	ggc	gaa	tcg	ctt	ctg	gtt	ccg	gtc	cac	gtc	4896
Met	Ala	Phe	Arg	Val	Pro	Gly	Glu	Ser	Leu	Leu	Val	Pro	Val	His	Val	
			1620					1625					1630			
gac	ctg	aac	gcc	ctg	cgc	gct	gat	gcg	gcc	gac	ggc	ggt	gtg	cct	gcg	4944
Asp	Leu	Asn	Ala	Leu	Arg	Ala	Asp	Ala	Ala	Asp	Gly	Gly	Val	Pro	Ala	
			1635				1640					1645				
ttg	ttg	cgc	gac	ctg	gtg	cca	gcg	ccc	gtg	cgg	cgg	agc	gcg	gtc	aac	4992
Leu	Leu	Arg	Asp	Leu	Val	Pro	Ala	Pro	Val	Arg	Arg	Ser	Ala	Val	Asn	
	1650					1655				1660						
gag	tcg	gcg	gac	gtc	aac	ggt	ctg	gtt	ggt	cgg	ctg	cgg	agg	ctg	ccg	5040
Glu	Ser	Ala	Asp	Val	Asn	Gly	Leu	Val	Gly	Arg	Leu	Arg	Arg	Leu	Pro	
1665					1670				1675						1680	
gac	ctg	gat	cag	gaa	acc	cag	ctg	ttg	ggt	ttg	gtg	cgc	gag	cat	gtt	5088
Asp	Leu	Asp	Gln	Glu	Thr	Gln	Leu	Leu	Gly	Leu	Val	Arg	Glu	His	Val	
			1685					1690						1695		
tcg	gcg	gtg	ctg	ggg	cat	tcg	ggt	gcg	gtc	gag	gtc	ggg	gcc	gat	cgt	5136
Ser	Ala	Val	Leu	Gly	His	Ser	Gly	Ala	Val	Glu	Val	Gly	Ala	Asp	Arg	
			1700				1705						1710			
gct	ttc	cgg	gat	ttg	ggt	ttt	gat	tcg	ttg	tcc	ggt	gtg	gag	ttt	cgg	5184
Ala	Phe	Arg	Asp	Leu	Gly	Phe	Asp	Ser	Leu	Ser	Gly	Val	Glu	Phe	Arg	
			1715				1720					1725				
aac	cgg	ctt	ggc	ggg	gtg	ctg	ggc	gtt	cgg	ttg	ccg	gct	act	gcg	gtg	5232
Asn	Arg	Leu	Gly	Gly	Val	Leu	Gly	Val	Arg	Leu	Pro	Ala	Thr	Ala	Val	
	1730					1735					1740					
ttc	gac	tat	ccg	aca	ccg	cgg	gcg	ttg	gtt	cgg	ttc	ttg	ctc	gac	aaa	5280

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Phe	Asp	Tyr	Pro	Thr	Pro	Arg	Ala	Leu	Val	Arg	Phe	Leu	Leu	Asp	Lys	
1745					1750					1755					1760	
ctg	att	ggt	ggc	gtg	gag	gct	ccg	act	ccc	gca	ccg	gcg	gct	gtg	gcg	5328
Leu	Ile	Gly	Gly	Val	Glu	Ala	Pro	Thr	Pro	Ala	Pro	Ala	Ala	Val	Ala	
				1765					1770					1775		
gcg	gtg	act	gct	gac	gat	ccc	gtt	gtg	atc	gtg	ggg	atg	ggc	tgt	cgt	5376
Ala	Val	Thr	Ala	Asp	Asp	Pro	Val	Val	Ile	Val	Gly	Met	Gly	Cys	Arg	
			1780					1785					1790			
tat	ccg	ggt	ggg	gtg	tcc	tcg	ccg	gag	gag	ctt	tgg	cgt	ttg	gtg	gcc	5424
Tyr	Pro	Gly	Gly	Val	Ser	Ser	Pro	Glu	Glu	Leu	Trp	Arg	Leu	Val	Ala	
		1795					1800					1805				
ggg	ggc	ttg	gat	gcg	gtg	gcg	gag	ttc	ccg	gac	gat	cgt	ggc	tgg	gat	5472
Gly	Gly	Leu	Asp	Ala	Val	Ala	Glu	Phe	Pro	Asp	Asp	Arg	Gly	Trp	Asp	
	1810					1815					1820					
cag	gcg	ggg	ttg	ttc	gat	ccg	gat	ccc	gat	cgt	ctt	ggg	acc	tcg	tat	5520
Gln	Ala	Gly	Leu	Phe	Asp	Pro	Asp	Pro	Asp	Arg	Leu	Gly	Thr	Ser	Tyr	
	1825				1830					1835					1840	
gtg	tgt	gag	ggt	ggc	ttc	ctg	cga	gat	gcg	gca	gag	ttc	gat	gcc	ggt	5568
Val	Cys	Glu	Gly	Gly	Phe	Leu	Arg	Asp	Ala	Ala	Glu	Phe	Asp	Ala	Gly	
			1845						1850					1855		
ttc	ttc	ggg	att	tcc	ccg	cgt	gag	gcg	ttg	gcg	atg	gat	ccg	cag	cag	5616
Phe	Phe	Gly	Ile	Ser	Pro	Arg	Glu	Ala	Leu	Ala	Met	Asp	Pro	Gln	Gln	
			1860					1865					1870			
cgg	ttg	ctg	ctg	gaa	gtc	gct	tgg	gaa	acc	gtg	gag	cgg	gcg	ggg	att	5664
Arg	Leu	Leu	Leu	Glu	Val	Ala	Trp	Glu	Thr	Val	Glu	Arg	Ala	Gly	Ile	
		1875					1880					1885				
gat	ccg	ctt	tcg	ttg	cgg	ggg	agc	cgg	acc	ggc	gtg	ttc	gcg	ggg	ctg	5712
Asp	Pro	Leu	Ser	Leu	Arg	Gly	Ser	Arg	Thr	Gly	Val	Phe	Ala	Gly	Leu	
	1890					1895					1900					
atg	cac	cac	gac	tac	ggc	gcg	cgg	ttc	atc	acg	agg	gcg	ccg	gag	ggt	5760
Met	His	His	Asp	Tyr	Gly	Ala	Arg	Phe	Ile	Thr	Arg	Ala	Pro	Glu	Gly	
	1905				1910					1915					1920	
ttc	gag	ggt	tat	cta	ggt	aat	ggc	agc	gcg	gga	ggc	gtg	ttt	tcg	ggt	5808
Phe	Glu	Gly	Tyr	Leu	Gly	Asn	Gly	Ser	Ala	Gly	Gly	Val	Phe	Ser	Gly	
				1925					1930					1935		
cgg	gtt	gcg	tat	tcg	ttt	ggt	ttc	gag	ggt	cct	gcg	gtg	acg	gtg	gat	5856
Arg	Val	Ala	Tyr	Ser	Phe	Gly	Phe	Glu	Gly	Pro	Ala	Val	Thr	Val	Asp	
			1940					1945					1950			
acg	gcg	tgt	tcg	tcg	tcg	ttg	gtg	gcg	ctg	cac	ctg	gcg	ggt	caa	gca	5904
Thr	Ala	Cys	Ser	Ser	Ser	Leu	Val	Ala	Leu	His	Leu	Ala	Gly	Gln	Ala	
		1955					1960					1965				
ctg	cgg	tct	ggt	gag	tgt	gat	ctg	gct	ctt	gcg	ggt	ggt	gtg	acg	gtg	5952
Leu	Arg	Ser	Gly	Glu	Cys	Asp	Leu	Ala	Leu	Ala	Gly	Gly	Val	Thr	Val	
	1970					1975					1980					
atg	gcc	acg	ccg	ggg	atg	ttc	gtg	gag	ttt	tcg	cgt	caa	cgg	ggc	ttg	6000
Met	Ala	Thr	Pro	Gly	Met	Phe	Val	Glu	Phe	Ser	Arg	Gln	Arg	Gly	Leu	
	1985				1990					1995					2000	

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gcg gcg gat ggg cgg tgc aag tcg ttt gcg gcg gct gcg gat ggc acc Ala Ala Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala Asp Gly Thr 2005 2010 2015	6048
ggt tgg gga gaa ggc gcg ggc ttg gtg ttg ttg gag cgg ctg tcg gat Gly Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp 2020 2025 2030	6096
gcc cgg cgc aac ggg cac gcg gtt ctg gcg gtc gtg cgg ggt agc gcg Ala Arg Arg Asn Gly His Ala Val Leu Ala Val Val Arg Gly Ser Ala 2035 2040 2045	6144
gtg aat cag gat ggt gcg tcg aat ggt ttg acg gcg ccg aat ggg ccc Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro 2050 2055 2060	6192
tcg cag cag cgg gtg atc acg cag gcg ttg gcg agt gct ggt ttg tcg Ser Gln Gln Arg Val Ile Thr Gln Ala Leu Ala Ser Ala Gly Leu Ser 2065 2070 2075 2080	6240
gtg tct gat gtg gac gcc gtg gag gcg cat ggg act gga acc agg ctt Val Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu 2085 2090 2095	6288
ggt gat ccg att gag gcg cag gct ctg att gcc act tac ggg cag ggg Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Gln Gly 2100 2105 2110	6336
cgg gat agc gat cgg ccg ttg tgg ttg ggg tcg gtg aag tcg aat att Arg Asp Ser Asp Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile 2115 2120 2125	6384
ggt cat acg cag gcg gcg gcg ggt gtc gct ggt gtg atc aag atg gtg Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val 2130 2135 2140	6432
atg gcg atg cgg cac ggg cag ctg ccc gcg acg ttg cat gtg gat gaa Met Ala Met Arg His Gly Gln Leu Pro Ala Thr Leu His Val Asp Glu 2145 2150 2155 2160	6480
cct acg tcg gaa gtg gat tgg tcg gcg ggg gat gtc cag ctc ctc acg Pro Thr Ser Glu Val Asp Trp Ser Ala Gly Asp Val Gln Leu Leu Thr 2165 2170 2175	6528
gag aac acc ccc tgg ccc ggc aac agc cat cct cgg cgg gtg ggc gtg Glu Asn Thr Pro Trp Pro Gly Asn Ser His Pro Arg Arg Val Gly Val 2180 2185 2190	6576
tcg tcg ttc ggg atc agc ggc acc aac gca cac gtc atc ctc gaa caa Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln 2195 2200 2205	6624
gcc tcg aaa aca cca gac gag act gcg gac aag agc ggt ccc gat tcg Ala Ser Lys Thr Pro Asp Glu Thr Ala Asp Lys Ser Gly Pro Asp Ser 2210 2215 2220	6672
gaa tcg acc gtg gac ctt cca gcg gtc ccg ttg atc gtg tcg ggg aga Glu Ser Thr Val Asp Leu Pro Ala Val Pro Leu Ile Val Ser Gly Arg 2225 2230 2235 2240	6720
aca ccg gca gcg ctc agc gct cag gcg agc gca ttg ttg tcc tat ttg Thr Pro Ala Ala Leu Ser Ala Gln Ala Ser Ala Leu Leu Ser Tyr Leu 2245 2250 2255	6768



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ggt gag cgt ggc gat att tcc acg ctg gat gcg gcg ttt tcg ttg gct Gly Glu Arg Gly Asp Ile Ser Thr Leu Asp Ala Ala Phe Ser Leu Ala 2260 2265 2270	6816
tcc tcc cgg gcc gcg ttg gag gag cgg gcg gtg gtg ctg gga gcg gac Ser Ser Arg Ala Ala Leu Glu Glu Arg Ala Val Val Leu Gly Ala Asp 2275 2280 2285	6864
cgc gaa acg ttg ttg tcc ggg ttg gaa gcg ctg gct tcc ggt cgc gag Arg Glu Thr Leu Leu Ser Gly Leu Glu Ala Leu Ala Ser Gly Arg Glu 2290 2295 2300	6912
gct tct ggg gtg gtg tcg gga tcc ccg gtc tct ggc ggg gtt ggg ttc Ala Ser Gly Val Val Ser Gly Ser Pro Val Ser Gly Gly Val Gly Phe 2305 2310 2315 2320	6960
gtg ttc gcc ggt cag ggc gga cag tgg ttg ggg atg ggc cgg ggg ctc Val Phe Ala Gly Gln Gly Gly Gln Trp Leu Gly Met Gly Arg Gly Leu 2325 2330 2335	7008
tac tcg gtt ttt ccg gtg ttc gct gac gcg ttt gac gaa gca tgt gcc Tyr Ser Val Phe Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Ala 2340 2345 2350	7056
gga ctg gac gcg cat ctg ggg cag gac gtg ggg gtc cgg gat gtg gtg Gly Leu Asp Ala His Leu Gly Gln Asp Val Gly Val Arg Asp Val Val 2355 2360 2365	7104
ttt ggt tcc gac ggg tcc ttg ttg gat cgg acg ctg tgg gcc cag tcg Phe Gly Ser Asp Gly Ser Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser 2370 2375 2380	7152
ggt ttg ttc gcg ttg cag gtt ggt ttg ctg agc ctg ctg ggt tcg tgg Gly Leu Phe Ala Leu Gln Val Gly Leu Leu Ser Leu Leu Gly Ser Trp 2385 2390 2395 2400	7200
ggt gtc cgg ccg ggt gtg gtg ctg ggc cat tcg gtc ggc gag ttc gcg Gly Val Arg Pro Gly Val Val Leu Gly His Ser Val Gly Glu Phe Ala 2405 2410 2415	7248
gcg gcg gtt gcg gcg gga gtg ttg tcg ttg ccg gat gcg gct cgg atg Ala Ala Val Ala Ala Gly Val Leu Ser Leu Pro Asp Ala Ala Arg Met 2420 2425 2430	7296
gtg gcg ggt cgt gcc cgg ttg atg cag gcg ttg cct tct ggc ggt gcc Val Ala Gly Arg Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Ala 2435 2440 2445	7344
atg ttg gcg gtg gct gct ggt gag gag cag ctg cgg ccg ttg ttg gcc Met Leu Ala Val Ala Ala Gly Glu Glu Gln Leu Arg Pro Leu Leu Ala 2450 2455 2460	7392
gat cgg gtt gat ggt gcg ggt atc gcc gcg gtc aac gct cct gag tcg Asp Arg Val Asp Gly Ala Gly Ile Ala Ala Val Asn Ala Pro Glu Ser 2465 2470 2475 2480	7440
gtg gtg ctc tcc ggc gat cgg gag gtg ctt gac gac atc gcc ggc gcg Val Val Leu Ser Gly Asp Arg Glu Val Leu Asp Asp Ile Ala Gly Ala 2485 2490 2495	7488
ctg gat ggg caa ggg att cgg tgg cgg cgg ttg cgg gtt tcg cat gcg Leu Asp Gly Gln Gly Ile Arg Trp Arg Arg Leu Arg Val Ser His Ala 2500 2505 2510 2515 2520 2525 2530 2535 2540 2545 2550	7536

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2500	2505	2510	
ttt cat tcg tat cgg atg gac ccg atg ttg cag gag ttc gcc gaa atc Phe His Ser Tyr Arg Met Asp Pro Met Leu Gln Glu Phe Ala Glu Ile 2515 2520 2525			7584
gca cgc agc gtg gac tac cgg cgt ggc gac cta ccg gtc gtg tcg acg Ala Arg Ser Val Asp Tyr Arg Arg Gly Asp Leu Pro Val Val Ser Thr 2530 2535 2540			7632
ttg acg ggt gag ctc gac acc gca ggt gtg atg gct acg ccg gag tat Leu Thr Gly Glu Leu Asp Thr Ala Gly Val Met Ala Thr Pro Glu Tyr 2545 2550 2555 2560			7680
tgg gtg cgt cag gtt cga gag ccc gtc cgc ttc gcc gac ggc gtc cgg Trp Val Arg Gln Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Arg 2565 2570 2575			7728
gtg ctc gcg cag caa ggg gtc gcc acg atc ttc gaa ctc ggc cct gat Val Leu Ala Gln Gln Gly Val Ala Thr Ile Phe Glu Leu Gly Pro Asp 2580 2585 2590			7776
gcg acg ctg tcg gcc ctg att ccc gat tgt cat tcg tgg gct gat cag Ala Thr Leu Ser Ala Leu Ile Pro Asp Cys His Ser Trp Ala Asp Gln 2595 2600 2605			7824
gcc atg ccg att ccg atg ctg cgt aaa gac cgt acg gaa acc gaa act Ala Met Pro Ile Pro Met Leu Arg Lys Asp Arg Thr Glu Thr Glu Thr 2610 2615 2620			7872
gtg gtc gcc gcg gtg gcg cgg gcg cac acg cgt ggt gtt ccg gtc gaa Val Val Ala Ala Val Ala Arg Ala His Thr Arg Gly Val Pro Val Glu 2625 2630 2635 2640			7920
tgg tcg gcg tat ttc gcc ggc acc ggg gca ccg ccg gtc gag ttg ccg Trp Ser Ala Tyr Phe Ala Gly Thr Gly Ala Arg Arg Val Glu Leu Pro 2645 2650 2655			7968
acg tat gcc ttc cag cgg cag cgg tac tgg ctg gaa aca tcg gat tac Thr Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Glu Thr Ser Asp Tyr 2660 2665 2670			8016
ggc gat gtg acg ggt atc ggc ctg gct gcg gcg gag cat ccg ttg ctg Gly Asp Val Thr Gly Ile Gly Leu Ala Ala Ala Glu His Pro Leu Leu 2675 2680 2685			8064
ggg gcc gtg gtt gcg ctg gcc gat ggt gat ggg atg gtg ctg acc ggc Gly Ala Val Val Ala Leu Ala Asp Gly Asp Gly Met Val Leu Thr Gly 2690 2695 2700			8112
cgg ttg tcg gtg ggg acg cat ccg tgg ctg gcc cag cat cgc gtg ctg Arg Leu Ser Val Gly Thr His Pro Trp Leu Ala Gln His Arg Val Leu 2705 2710 2715 2720			8160
ggc gag gtc gtc gtc ccc ggc acc gcc atc ctg gag atg gcc ctg cac Gly Glu Val Val Val Pro Gly Thr Ala Ile Leu Glu Met Ala Leu His 2725 2730 2735			8208
gca ggg gcg cgt ctc ggc tgt gac cgg gtg gaa gag ctc acc ctg gaa Ala Gly Ala Arg Leu Gly Cys Asp Arg Val Glu Glu Leu Thr Leu Glu 2740 2745 2750			8256
aca ccg ctg gtg gtc ccc gaa cgc gcg gcg ggt gcc ggt agt cgt ggc			8304

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Thr	Pro	Leu	Val	Val	Pro	Glu	Arg	Ala	Ala	Gly	Ala	Gly	Ser	Arg	Gly		
		2755					2760					2765					
cct	gcg	gga	ggg	acc	aca	gtt	tca	att	gaa	act	gcg	gaa	gaa	cgt	gtg	8352	
Pro	Ala	Gly	Gly	Thr	Thr	Val	Ser	Ile	Glu	Thr	Ala	Glu	Glu	Arg	Val		
	2770					2775					2780						
cgg	acg	aac	gac	gcc	atc	gaa	atc	cag	ctg	ctg	gtg	aac	gca	ccc	gac	8400	
Arg	Thr	Asn	Asp	Ala	Ile	Glu	Ile	Gln	Leu	Leu	Val	Asn	Ala	Pro	Asp		
	2785				2790					2795					2800		
gaa	ggc	ggt	cgg	cga	agg	gtg	tcg	ctg	tat	tcc	cgc	ccg	gcc	ggt	ggg	8448	
Glu	Gly	Gly	Arg	Arg	Arg	Val	Ser	Leu	Tyr	Ser	Arg	Pro	Ala	Gly	Gly		
				2805					2810					2815			
tcg	aga	ggt	ggg	ggt	tgg	acg	cgc	cac	gcc	acc	ggc	gaa	ctc	gtc	gtc	8496	
Ser	Arg	Gly	Gly	Gly	Trp	Thr	Arg	His	Ala	Thr	Gly	Glu	Leu	Val	Val		
		2820						2825					2830				
ggc	acc	acc	ggt	ggt	agg	gcg	gtt	cct	gat	tgg	tcg	gct	gag	ggt	gcc	8544	
Gly	Thr	Thr	Gly	Gly	Arg	Ala	Val	Pro	Asp	Trp	Ser	Ala	Glu	Gly	Ala		
	2835						2840					2845					
gag	tcg	att	gct	ctc	gat	gag	ttc	tac	gtc	gct	ctg	gcc	gga	aac	ggg	8592	
Glu	Ser	Ile	Ala	Leu	Asp	Glu	Phe	Tyr	Val	Ala	Leu	Ala	Gly	Asn	Gly		
	2850					2855					2860						
ttc	gag	tac	ggg	ccg	ttg	ttc	cag	ggg	ctt	cag	gcg	gca	tgg	cgt	cgt	8640	
Phe	Glu	Tyr	Gly	Pro	Leu	Phe	Gln	Gly	Leu	Gln	Ala	Ala	Trp	Arg	Arg		
	2865				2870					2875					2880		
ggt	gac	gag	gtt	ctc	gcc	gaa	atc	gcc	ccg	ccg	gcc	gag	gcc	gat	gcg	8688	
Gly	Asp	Glu	Val	Leu	Ala	Glu	Ile	Ala	Pro	Pro	Ala	Glu	Ala	Asp	Ala		
			2885						2890					2895			
atg	gcg	tcg	gga	tac	ctg	ctc	gac	cca	gcg	ttg	ctg	gat	gcc	gcg	ctg	8736	
Met	Ala	Ser	Gly	Tyr	Leu	Leu	Asp	Pro	Ala	Leu	Leu	Asp	Ala	Ala	Leu		
		2900						2905					2910				
cag	gcg	tcc	gcg	ctc	ggc	gac	cgc	ccg	gag	caa	ggc	ggc	gcg	tgg	ctg	8784	
Gln	Ala	Ser	Ala	Leu	Gly	Asp	Arg	Pro	Glu	Gln	Gly	Gly	Ala	Trp	Leu		
	2915						2920					2925					
ccg	ttc	tca	ttc	acc	ggc	gtc	gaa	ctt	tcc	gct	ccg	gca	ggg	acg	atc	8832	
Pro	Phe	Ser	Phe	Thr	Gly	Val	Glu	Leu	Ser	Ala	Pro	Ala	Gly	Thr	Ile		
	2930					2935					2940						
agc	agg	gtg	cgg	ctg	gag	acc	agg	cga	ccc	gac	gcg	ata	tcg	gtg	gcc	8880	
Ser	Arg	Val	Arg	Leu	Glu	Thr	Arg	Arg	Pro	Asp	Ala	Ile	Ser	Val	Ala		
	2945				2950					2955					2960		
gtg	atg	gat	gag	agt	ggg	cgg	ttg	ctc	gcc	tcg	atc	gat	tct	ctc	agg	8928	
Val	Met	Asp	Glu	Ser	Gly	Arg	Leu	Leu	Ala	Ser	Ile	Asp	Ser	Leu	Arg		
				2965					2970					2975			
cta	cga	agc	gtg	tcg	tcg	gga	cag	ctg	gcg	aat	cgg	gac	gct	gtc	cgc	8976	
Leu	Arg	Ser	Val	Ser	Ser	Gly	Gln	Leu	Ala	Asn	Arg	Asp	Ala	Val	Arg		
			2980					2985					2990				
gac	gcg	ctg	ttc	gag	gtg	acc	tgg	gag	ccg	gtg	gcg	acg	cag	tcg	acg	9024	
Asp	Ala	Leu	Phe	Glu	Val	Thr	Trp	Glu	Pro	Val	Ala	Thr	Gln	Ser	Thr		
	2995						3000					3005					

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gaa ccg ggt cgc tgg gcc ctg ctt ggt gat act gcc tgc ggt aaa gac Glu Pro Gly Arg Trp Ala Leu Leu Gly Asp Thr Ala Cys Gly Lys Asp 3010 3015 3020	9072
gat ctg atc aaa ctg gca acg gat tcc gcc gac cgc tgc gcg gat ctg Asp Leu Ile Lys Leu Ala Thr Asp Ser Ala Asp Arg Cys Ala Asp Leu 3025 3030 3035 3040	9120
gcg gcg cta gcc gag aaa ctt gat tcc agc gcg ctg gtt cct gat gtc Ala Ala Leu Ala Glu Lys Leu Asp Ser Ser Ala Leu Val Pro Asp Val 3045 3050 3055	9168
gtg gtc tac tgc gcc gga gaa cag gcg gat ccc ggc acc ggc gca gcc Val Val Tyr Cys Ala Gly Glu Gln Ala Asp Pro Gly Thr Gly Ala Ala 3060 3065 3070	9216
gca ctt gcg gag acc cag cag acg ttg gct ctg ctg caa gcg tgg ttg Ala Leu Ala Glu Thr Gln Gln Thr Leu Ala Leu Leu Gln Ala Trp Leu 3075 3080 3085	9264
gct gag ccg cgg ttg gcc gag gca cgt ctg gtg gtg gtg acg tgt gca Ala Glu Pro Arg Leu Ala Glu Ala Arg Leu Val Val Val Thr Cys Ala 3090 3095 3100	9312
gcg gtg acg acg gct ccg agt gac ggt gca tca gag ctg gca cat gcg Ala Val Thr Thr Ala Pro Ser Asp Gly Ala Ser Glu Leu Ala His Ala 3105 3110 3115 3120	9360
ccg ttg tgg ggg ttg ttg cgt gcc gcg cag gtg gag aac ccg ggg cag Pro Leu Trp Gly Leu Leu Arg Ala Ala Gln Val Glu Asn Pro Gly Gln 3125 3130 3135	9408
ttt gtg ctg gcg gac gtc gac gga acc gcc gaa tcg tgg cgt gcg ttg Phe Val Leu Ala Asp Val Asp Gly Thr Ala Glu Ser Trp Arg Ala Leu 3140 3145 3150	9456
ccg agt gcg ttg ggc tcg atg gaa ccg cag ttg gcc ctg cgg aag ggc Pro Ser Ala Leu Gly Ser Met Glu Pro Gln Leu Ala Leu Arg Lys Gly 3155 3160 3165	9504
gcg gtg cga gcg ccc cgc ttg gct tcg gtc gcc ggg cag atc gac gtg Ala Val Arg Ala Pro Arg Leu Ala Ser Val Ala Gly Gln Ile Asp Val 3170 3175 3180	9552
ccc gcg gtt gtg gcg gat ccc gac cga acc gtg ctg att tcg ggc ggc Pro Ala Val Val Ala Asp Pro Asp Arg Thr Val Leu Ile Ser Gly Gly 3185 3190 3195 3200	9600
acg ggc ctg ttg ggg ggc gcg gtt gcc cgc cac ctg gtg acc gaa gcg Thr Gly Leu Leu Gly Gly Ala Val Ala Arg His Leu Val Thr Glu Arg 3205 3210 3215	9648
ggt gtc cgc cga ttg gtg ttg acg ggc cgt cgt ggc tgg gat gct cct Gly Val Arg Arg Leu Val Leu Thr Gly Arg Arg Gly Trp Asp Ala Pro 3220 3225 3230	9696
gga atc acc gag ttg gtg ggt gag ctg aac ggc ctc ggt gcc gtg gtc Gly Ile Thr Glu Leu Val Gly Glu Leu Asn Gly Leu Gly Ala Val Val 3235 3240 3245	9744
gac gtg gtg gcg tgc gac gtc gcg gat cgt gct gat ctg gag tcg ttg Asp Val Val Ala Cys Asp Val Ala Asp Arg Ala Asp Leu Glu Ser Leu 3250 3255 3260	9792

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ctg gcg gcg gtc ccg gcg gaa ttt ccg ttg tgc ggc gtg gtg cat gcc Leu Ala Ala Val Pro Ala Glu Phe Pro Leu Cys Gly Val Val His Ala 3265 3270 3275 3280	9840
gcg ggg gcg ctg gcc gac ggg gtg atc gag tgc ttg tca ccg gac gac Ala Gly Ala Leu Ala Asp Gly Val Ile Glu Ser Leu Ser Pro Asp Asp 3285 3290 3295	9888
gtg gga gcg gtg ttc ggc ccg aag gcg gcg ggg gcg tgg aat ctg cac Val Gly Ala Val Phe Gly Pro Lys Ala Ala Gly Ala Trp Asn Leu His 3300 3305 3310	9936
gag ctg act cgt gat acg gac ctg tgc ttc ttc gcg ttg ttc tcc tgc Glu Leu Thr Arg Asp Thr Asp Leu Ser Phe Phe Ala Leu Phe Ser Ser 3315 3320 3325	9984
ctt tcc ggt gtt gcc ggc gct cct ggt cag ggc aat tat gcg gcg gcg Leu Ser Gly Val Ala Gly Ala Pro Gly Gln Gly Asn Tyr Ala Ala Ala 3330 3335 3340	10032
aac gcg ttc ctg gac gca ttg gcg cat tac cgg cgg tca cag gga ctg Asn Ala Phe Leu Asp Ala Leu Ala His Tyr Arg Arg Ser Gln Gly Leu 3345 3350 3355 3360	10080
cct gcg gtg tgc ctg gcc tgg ggc ctg tgg gag cag ccg agc ggg atg Pro Ala Val Ser Leu Ala Trp Gly Leu Trp Glu Gln Pro Ser Gly Met 3365 3370 3375	10128
acg gag acg ctc agc gag gtc gac cgg agc agg atc gcg cgc gcc aac Thr Glu Thr Leu Ser Glu Val Asp Arg Ser Arg Ile Ala Arg Ala Asn 3380 3385 3390	10176
ccg ccg ttg tcc acc aag gag gga ttg cgg ctg ttc gat gcc ggg ctg Pro Pro Leu Ser Thr Lys Glu Gly Leu Arg Leu Phe Asp Ala Gly Leu 3395 3400 3405	10224
gcg ctg gac cgg gca gcg gta gtt ccg gcg aag ttg gac agg act ttc Ala Leu Asp Arg Ala Ala Val Val Pro Ala Lys Leu Asp Arg Thr Phe 3410 3415 3420	10272
ctg gcc gag cag gcg cgg tgc ggc tgc ctg ccc gca ttg ttg acg gca Leu Ala Glu Gln Ala Arg Ser Gly Ser Leu Pro Ala Leu Leu Thr Ala 3425 3430 3435 3440	10320
ctg gta ccc ccc atc cgt cgt aat agg cgg gct agc gga acc gag ctc Leu Val Pro Pro Ile Arg Arg Asn Arg Arg Ala Ser Gly Thr Glu Leu 3445 3450 3455	10368
gcg gac gag ggc acc ctg ctc ggg gtg gtg cgg gag cat gcc gcg gcc Ala Asp Glu Gly Thr Leu Leu Gly Val Val Arg Glu His Ala Ala Ala 3460 3465 3470	10416
gtg ctg ggg tat tgc agc gcg gct gac gtc ggg gtc gag cgc gct ttc Val Leu Gly Tyr Ser Ser Ala Ala Asp Val Gly Val Glu Arg Ala Phe 3475 3480 3485	10464
cgg gat ctg ggt ttt gat tgc ttg tct ggt gtg gag ttg cgg aac cgc Arg Asp Leu Gly Phe Asp Ser Leu Ser Gly Val Glu Leu Arg Asn Arg 3490 3495 3500	10512
ctt gcc ggg gtg ctg ggg gtg cgg ttg ccg gcg act gcg gtg ttc gac Leu Ala Gly Val Leu Gly Val Arg Leu Pro Ala Thr Ala Val Phe Asp 3505 3510 3515	10560

3505	3510	LeA33955-US 3515	3520	
tat ccg acg ccg agg gcg ctg gcc cgg ttc ctg cac cag gaa ctg gca Tyr Pro Thr Pro Arg Ala Leu Ala Arg Phe Leu His Gln Glu Leu Ala	3525	3530	3535	10608
gac gag atc gct acg acg cca gcg ccg gtg acg acg acc agg gca ccg Asp Glu Ile Thr Thr Pro Ala Pro Val Thr Thr Thr Arg Ala Pro	3540	3545	3550	10656
gtc gcc gaa gac gat ctc gtc gcg ata gtc ggg atg gga tgc cgt ttt Val Ala Glu Asp Asp Leu Val Ala Ile Val Gly Met Gly Cys Arg Phe	3555	3560	3565	10704
ccc ggt cag gtg tcc tcg ccg gag gag ctc tgg cgt ttg gtg gcc ggg Pro Gly Gln Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala Gly	3570	3575	3580	10752
ggc gtg gat gcg gtc gcg gac ttc cca gcc gat cgc ggc tgg gat ctg Gly Val Asp Ala Val Ala Asp Phe Pro Ala Asp Arg Gly Trp Asp Leu	3585	3590	3595	10800
gca ggc ttg ttc gat ccg gac ccg gaa cgg gct ggg aag acc tac gtg Ala Gly Leu Phe Asp Pro Asp Pro Glu Arg Ala Gly Lys Thr Tyr Val	3605	3610	3615	10848
cgg gaa ggg gcc ttc ctc acc gac gcc gat cgg ttc gat gcg ggt ttc Arg Glu Gly Ala Phe Leu Thr Asp Ala Asp Arg Phe Asp Ala Gly Phe	3620	3625	3630	10896
ttc ggg att tcc ccg cgt gag gcg ttg gcg atg gat ccg cag caa cgg Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg	3635	3640	3645	10944
ctg ttg ctg gag ctg tcc tgg gag gcc att gaa cgg gca ggg atc gat Leu Leu Leu Glu Leu Ser Trp Glu Ala Ile Glu Arg Ala Gly Ile Asp	3650	3655	3660	10992
ccg ggt tcg ctg agg ggg agt cgg acc ggt gtg ttc gcg ggg ctg atg Pro Gly Ser Leu Arg Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met	3665	3670	3675	11040
tac cac gac tat ggc gcc ccg ttc gcc agc cga gcc ccg gaa ggt ttc Tyr His Asp Tyr Gly Ala Arg Phe Ala Ser Arg Ala Pro Glu Gly Phe	3685	3690	3695	11088
gag ggg tat ctc ggc aat ggc agt gct ggg agt gtc gcg tcg ggc ccg Glu Gly Tyr Leu Gly Asn Gly Ser Ala Gly Ser Val Ala Ser Gly Arg	3700	3705	3710	11136
att gcg tac tcg ttt ggt ttc gag ggt cct gcg gtg acg gtg gat act Ile Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr	3715	3720	3725	11184
gcg tgt tcg tcg tcg ttg gtg gcg ttg cat ttg gcg ggt cag tcg ttg Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ser Leu	3730	3735	3740	11232
cgt tcc ggc gaa tgc gat ctc gcc ctt gcc ggt ggt gtg acg gtg atg Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Val Thr Val Met	3745	3750	3755	11280
tcg acg ccc ggg acg ttt gtg gaa ttc tcc cgt cag ccg ggc ctg gca				11328

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Ser Thr Pro Gly Thr Phe Val Glu Phe	Ser Arg Gln Arg Gly Leu Ala	
3765	3770 3775	
ccg gac ggg cgg tgc aag tcg ttc gcg gag agc gcg gac ggt acc ggt	11376	
Pro Asp Gly Arg Cys Lys Ser Phe Ala Glu Ser Ala Asp Gly Thr Gly		
3780	3785 3790	
tgg ggt gag ggt gct ggt ttg gtg ttg ttg gag cgg ttg tcg gat gct	11424	
Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala		
3795	3800 3805	
cgg cgg aat ggg cat cgg gtg ttg gcg gtg gtt cgt ggg tcg gcg gtg	11472	
Arg Arg Asn Gly His Arg Val Leu Ala Val Val Arg Gly Ser Ala Val		
3810	3815 3820	
aat cag gat ggt gcg tcg aat ggc ttg acc gcg ccg aat ggt ccc tcg	11520	
Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser		
3825	3830 3835 3840	
cag cag cgg gtc atc cag cag gcg ttg gcg agt gcg ggt ctg tcg gtg	11568	
Gln Gln Arg Val Ile Gln Gln Ala Leu Ala Ser Ala Gly Leu Ser Val		
3845	3850 3855	
tcc gat gtg gat gcc gtg gag gcg cat ggg acc ggg acc agg ttg ggt	11616	
Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly		
3860	3865 3870	
gat ccg att gag gcg cag gct ctg att gct acg tat ggg cgc gat cgt	11664	
Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg		
3875	3880 3885	
gat ccc ggt cgg ccg ttg tgg ttg ggg tcg gtg aag tcc aac atc ggt	11712	
Asp Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly		
3890	3895 3900	
cat acg cag gcg gcg gcg ggt gtt gcc ggt gtg atc aag atg gtg atg	11760	
His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met		
3905	3910 3915 3920	
gcg atg cgg cac ggg caa ctt ccg cgc acg ctg cac gtg gat gca ccc	11808	
Ala Met Arg His Gly Gln Leu Pro Arg Thr Leu His Val Asp Ala Pro		
3925	3930 3935	
tcc tcg cag gtg gat tgg tcg gcg ggg agg gtc cag ctc ctg acg gag	11856	
Ser Ser Gln Val Asp Trp Ser Ala Gly Arg Val Gln Leu Leu Thr Glu		
3940	3945 3950	
aac acg ccc tgg ccc gac agt ggt cgc ccc tgt cgg gtg ggg gtg tcg	11904	
Asn Thr Pro Trp Pro Asp Ser Gly Arg Pro Cys Arg Val Gly Val Ser		
3955	3960 3965	
tcg ttc ggg atc agc ggc acc aac gcg cac gtc atc ctg gaa cag tcc	11952	
Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Ser		
3970	3975 3980	
acg ggg cag atg gat cag gca gcg gag ccg gat tcg agt cct gtt ctg	12000	
Thr Gly Gln Met Asp Gln Ala Ala Glu Pro Asp Ser Ser Pro Val Leu		
3985	3990 3995 4000	
gat gtt ccg gtg gtg ccg tgg gtg gtg tcg ggc aaa aca ccc gaa gcg	12048	
Asp Val Pro Val Val Pro Trp Val Val Ser Gly Lys Thr Pro Glu Ala		
4005	4010 4015	

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cta tcc gcc cag gcg gca acg ttg gcg acc tat ttg gac caa aat gtt Leu Ser Ala Gln Ala Ala Thr Leu Ala Thr Tyr Leu Asp Gln Asn Val 4020 4025 4030	12096
gat gtc tcc cct ctg gac gtt ggg att tcg ctt gcg gtg acc cgt tcg Asp Val Ser Pro Leu Asp Val Gly Ile Ser Leu Ala Val Thr Arg Ser 4035 4040 4045	12144
gcg ctg gat gag cgg gcg gtg gtg ctg ggg tcg gat cgt gac acg ttg Ala Leu Asp Glu Arg Ala Val Val Leu Gly Ser Asp Arg Asp Thr Leu 4050 4055 4060	12192
ttg tct ggc ctg aat gcg ctg gct gcc ggt cat gag gct gct ggc gtg Leu Ser Gly Leu Asn Ala Leu Ala Ala Gly His Glu Ala Ala Gly Val 4065 4070 4075 4080	12240
gtt acg gga cct gtc ggg att ggt ggc cgg acc ggg ttt gtg ttc gcc Val Thr Gly Pro Val Gly Ile Gly Gly Arg Thr Gly Phe Val Phe Ala 4085 4090 4095	12288
ggt caa ggc ggt cag tgg ttg ggg atg ggc cgc cgg ttg tac tcg gag Gly Gln Gly Gly Gln Trp Leu Gly Met Gly Arg Arg Leu Tyr Ser Glu 4100 4105 4110	12336
ttt ccg gcg ttc gcc ggt gct ttc gac gaa gca tgc gcc gag ctc gat Phe Pro Ala Phe Ala Gly Ala Phe Asp Glu Ala Cys Ala Glu Leu Asp 4115 4120 4125	12384
gcg aac ctg ggg agg gaa gtc ggg gtt cgg gat gtg gtg ttc ggc tcc Ala Asn Leu Gly Arg Glu Val Gly Val Arg Asp Val Val Phe Gly Ser 4130 4135 4140	12432
gac gag tcc ttg ctg gat cgg act ttg tgg gcg cag tcg ggt ttg ttc Asp Glu Ser Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser Gly Leu Phe 4145 4150 4155 4160	12480
gcg ttg cag gtc ggt ctc tgg gaa ttg ttg ggt acg tgg ggt gtt cgg Ala Leu Gln Val Gly Leu Trp Glu Leu Leu Gly Thr Trp Gly Val Arg 4165 4170 4175	12528
ccc agc gta gtg ctg ggg cat tcg gtc ggg gag cta gcc gcg gcg ttc Pro Ser Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe 4180 4185 4190	12576
gcc gca ggt gtg ctg tcg atg gcg gag gcg gct cgg ctg gtg gcg ggt Ala Ala Gly Val Leu Ser Met Ala Glu Ala Ala Arg Leu Val Ala Gly 4195 4200 4205	12624
cgt gcg cgg ttg atg cag gcg ttg cct tct ggc ggt gcc atg ctg gcg Arg Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Ala Met Leu Ala 4210 4215 4220	12672
gtg tcc gcg acc gag gcc cga gtc ggc ccg ctg ctc gat ggg gtg cgg Val Ser Ala Thr Glu Ala Arg Val Gly Pro Leu Leu Asp Gly Val Arg 4225 4230 4235 4240	12720
gat cgt gtt ggt gtc gca gcg gtt aac gct ccg ggg tcg gtg gtg ctt Asp Arg Val Gly Val Ala Ala Val Asn Ala Pro Gly Ser Val Val Leu 4245 4250 4255	12768
tcc ggt gac cgg gat gtg ctc gat ggc att gcc ggt cgg ctg gac ggg Ser Gly Asp Arg Asp Val Leu Asp Gly Ile Ala Gly Arg Leu Asp Gly 4260 4265 4270	12816



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caa ggt atc cgg tcg agg tgg ttg cgg gtt tcg cac gcg ttt cat tcg Gln Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser 4275 4280 4285	12864
cat cgg atg gat ccg atg ctg gcg gag ttc gcc gag ctc gca cgg agc His Arg Met Asp Pro Met Leu Ala Glu Phe Ala Glu Leu Ala Arg Ser 4290 4295 4300	12912
gtg gac tac cgg tct cca cgg ctg ccg att gtc tcg acg ctg acc gga Val Asp Tyr Arg Ser Pro Arg Leu Pro Ile Val Ser Thr Leu Thr Gly 4305 4310 4315 4320	12960
aac ctc gat gac gtg ggc gtg atg gct acg ccg gag tat tgg gtg cgc Asn Leu Asp Asp Val Gly Val Met Ala Thr Pro Glu Tyr Trp Val Arg 4325 4330 4335	13008
cag gtg cga gag ccc gtc cgc ttc gcc gac ggt gtc cag gcg ctt gtg Gln Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Gln Ala Leu Val 4340 4345 4350	13056
gac caa ggc gtc gac acg att gtg gaa ctc ggt ccg gac ggg gcg ttg Asp Gln Gly Val Asp Thr Ile Val Glu Leu Gly Pro Asp Gly Ala Leu 4355 4360 4365	13104
tcg agc ttg gtt caa gag tgt gtg gcg gag tcc ggg ccg gcg acg ggg Ser Ser Leu Val Gln Glu Cys Val Ala Glu Ser Gly Arg Ala Thr Gly 4370 4375 4380	13152
att ccg ttg gtg cgg aga gac cgt gat gag gtc cga acg gtg ctg gac Ile Pro Leu Val Arg Arg Asp Arg Asp Glu Val Arg Thr Val Leu Asp 4385 4390 4395 4400	13200
gct ttg gcg cag acc cac act cgt ggt ggc gcg gtg gac tgg ggg tca Ala Leu Ala Gln Thr His Thr Arg Gly Gly Ala Val Asp Trp Gly Ser 4405 4410 4415	13248
ttt ttc gct ggt acg agg gca acg caa gtc gac ctt ccc acg tat gcc Phe Phe Ala Gly Thr Arg Ala Thr Gln Val Asp Leu Pro Thr Tyr Ala 4420 4425 4430	13296
ttc caa cga cag cgg tac tgg ctg gag cca tcg gat tcc ggt gat gtg Phe Gln Arg Gln Arg Tyr Trp Leu Glu Pro Ser Asp Ser Gly Asp Val 4435 4440 4445	13344
acc ggt gtt ggc ctg acc ggg gcg gag cat ccg ctg ttg ggt gcc gtg Thr Gly Val Gly Leu Thr Gly Ala Glu His Pro Leu Leu Gly Ala Val 4450 4455 4460	13392
gtg ccg gtc gcg ggc ggc gat gag gtg ctg ctg acc ggc agg ctg tcg Val Pro Val Ala Gly Gly Asp Glu Val Leu Leu Thr Gly Arg Leu Ser 4465 4470 4475 4480	13440
gtg ggg acg cat ccg tgg ctg gcg gaa cac cgc gtg ctg ggc gaa gtc Val Gly Thr His Pro Trp Leu Ala Glu His Arg Val Leu Gly Glu Val 4485 4490 4495	13488
gtc gtc ccc ggc acc gcg ttg ctg gag atg gcg tgg ccg gcc ggt agc Val Val Pro Gly Thr Ala Leu Leu Glu Met Ala Trp Arg Ala Gly Ser 4500 4505 4510	13536
cag gtc ggt tgt gaa cgt gtg gag gag ctc acc ttg gag gca ccg ctg Gln Val Gly Cys Glu Arg Val Glu Glu Leu Thr Leu Glu Ala Pro Leu 4515 4520 4525	13584

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4515	4520	4525	
gtc ctg ccg gag cgg ggc gct gcg gcg gtg cag ttg gcg gtg ggg gct Val Leu Pro Glu Arg Gly Ala Ala Ala Val Gln Leu Ala Val Gly Ala 4530 4535 4540			13632
ccg gat gag gcc ggc cgg cgc agt ttg cag ctc tat tcc cga ggc gct Pro Asp Glu Ala Gly Arg Arg Ser Leu Gln Leu Tyr Ser Arg Gly Ala 4545 4550 4555 4560			13680
gat gaa gac ggc gac tgg cgg cgg att gcc tcc ggg ctg ttg gcc cag Asp Glu Asp Gly Asp Trp Arg Arg Ile Ala Ser Gly Leu Leu Ala Gln 4565 4570 4575			13728
gcc aat gcg gtg ccg ccg gcg gat tcg acg gca tgg ccg ccg gac ggc Ala Asn Ala Val Pro Pro Ala Asp Ser Thr Ala Trp Pro Pro Asp Gly 4580 4585 4590			13776
gcc ggg cag gtc gat ctg gcg gag ttc tac gag cgc ctc gcc gag cgc Ala Gly Gln Val Asp Leu Ala Glu Phe Tyr Glu Arg Leu Ala Glu Arg 4595 4600 4605			13824
ggc ttg acc tac ggt ccg gta ttc caa ggg ctc cgc gcc gca tgg cgg Gly Leu Thr Tyr Gly Pro Val Phe Gln Gly Leu Arg Ala Ala Trp Arg 4610 4615 4620			13872
cac ggc gac gat atc ttc gcc gaa ttg gcc ggg tca cca gac gcc tcg His Gly Asp Asp Ile Phe Ala Glu Leu Ala Gly Ser Pro Asp Ala Ser 4625 4630 4635 4640			13920
ggt ttc ggc atc cac ccg gcg ctg ctg gac gct gca ctg cac gcg atg Gly Phe Gly Ile His Pro Ala Leu Leu Asp Ala Ala Leu His Ala Met 4645 4650 4655			13968
gcg ctt ggt gct tcg ccc gac tcg gaa gcg cgt ctg ccg ttt tcc tgg Ala Leu Gly Ala Ser Pro Asp Ser Glu Ala Arg Leu Pro Phe Ser Trp 4660 4665 4670			14016
cgt ggc gcc cag ctg tac cgc gct gaa gga gca gcg ctt cgg gta cgg Arg Gly Ala Gln Leu Tyr Arg Ala Glu Gly Ala Ala Leu Arg Val Arg 4675 4680 4685			14064
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aca ggg cga cga gtc gct gcg gtg gaa tcg ctt tcg acg cga ccg gtc Thr Gly Arg Arg Val Ala Ala Val Glu Ser Leu Ser Thr Arg Pro Val 4705 4710 4715 4720			14160
tcc acc gac cag atc ggt gcc ggt cgc ggc gat caa gag cgg ctg ctg Ser Thr Asp Gln Ile Gly Ala Gly Arg Gly Asp Gln Glu Arg Leu Leu 4725 4730 4735			14208
cac gtc gag tgg gta agg tcg gct gaa tct gcg ggg atg tct ctg acc His Val Glu Trp Val Arg Ser Ala Glu Ser Ala Gly Met Ser Leu Thr 4740 4745 4750			14256
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Ala Thr Glu Val Ala Lys Arg Gly Ser Ala Pro Gly Ala Val Ile Val	
4785 4790 4795 4800	
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Pro Cys Pro Arg Pro Arg Ala Met Gln Glu Leu Pro Thr Ala Ala Arg	
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Arg Ala Thr Gln Gln Ala Met Ala Met Leu Gln Gln Trp Leu Ala Asp	
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Asp Arg Phe Val Ser Thr Arg Leu Ile Leu Leu Thr His Arg Ala Val	
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Ser Ala Val Ala Gly Glu Asp Val Leu Asp Leu Val His Ala Pro Leu	
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Trp Gly Leu Val Arg Ser Ala Gln Ala Glu His Pro Asp Arg Phe Ala	
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Leu Ile Asp Met Asp Asp Glu Arg Ala Ser Gln Thr Ala Leu Ala Glu	
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Ala Leu Thr Ala Gly Glu Ala Gln Leu Ala Val Arg Ser Gly Val Val	
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Leu Ala Pro Arg Leu Gly Gln Val Lys Val Ser Gly Gly Glu Ala Phe	
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agg tgg gat gaa ggc acc gtg ctg gtc acc ggc gga acc ggc ggg ctc	14832
Arg Trp Asp Glu Gly Thr Val Leu Val Thr Gly Gly Thr Gly Gly Leu	
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Gly Ala Leu Leu Ala Arg His Leu Val Ser Ala His Gly Val Arg His	
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Leu Val Ala Glu Leu Glu Gln Ala Gly Ala Asp Val Ala Val Val Ala	
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Cys Asp Ser Ala Asp Arg Asp Ser Leu Ala Arg Leu Val Ala Ser Val	
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cct gcg gaa aac ccg ttg cgg gtg gtg gtg cac gcc gcc ggt gtg ctg	15072
Pro Ala Glu Asn Pro Leu Arg Val Val Val His Ala Ala Gly Val Leu	
5010 5015 5020	

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ttg cgg ccc aaa gtg gat gcc gcg tgg tac ctg cac gag ctg act cgg Leu Arg Pro Lys Val Asp Ala Ala Trp Tyr Leu His Glu Leu Thr Arg 5045 5050 5055	15168
gaa ctc ggt ctg tcg gcg ttc gtg ttg ttc tcc tcg gtc gcg ggc ctg Glu Leu Gly Leu Ser Ala Phe Val Leu Phe Ser Ser Val Ala Gly Leu 5060 5065 5070	15216
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gat gcc ttg gcg cat tgc cgg cag gcc cag ggg ctg ccc gcg ctg tcg Asp Ala Leu Ala His Cys Arg Gln Ala Gln Gly Leu Pro Ala Leu Ser 5090 5095 5100	15312
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cag gcc cga tcc gtg cag acc cgg att ccg gaa atg ctg cat ggc atg Gln Ala Arg Ser Val Gln Thr Arg Ile Pro Glu Met Leu His Gly Met 5170 5175 5180	15552
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agg ttc tcc gtg gcg atg gcc cac cgg acg tat gag aag ctc gcg act Arg Phe Ser Val Ala Met Ala His Arg Thr Tyr Glu Lys Leu Ala Thr 5475 5480 5485	16464
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cag gtg ccg ggc gac cac ttc tcg atg atg gac gag cac gcc ggg tcc Gln Val Pro Gly Asp His Phe Ser Met Met Asp Glu His Ala Gly Ser	5555	5560	5565
acc gca cag gca gtc gcg agt tgg ctt gac aaa ctc aac cag cgc acc Thr Ala Gln Ala Val Ala Ser Trp Leu Asp Lys Leu Asn Gln Arg Thr	5570	5575	5580
gct cgg caa cgc tga Ala Arg Gln Arg			

16656

16704

16752

16767

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 <211> 5588  
 <212> PRT  
 <213> Saccharopolyspora spinosa

<400> 50  
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 Glu Leu Glu Glu Ala His Glu Arg Leu His Glu Leu Glu Arg Gln Glu  
 20 25 30  
 His Asp Pro Ile Ala Ile Val Ser Met Gly Cys Arg Tyr Pro Gly Gly  
 35 40 45  
 Val Ser Thr Pro Glu Glu Leu Trp Arg Leu Val Val Asp Gly Gly Asp  
 50 55 60  
 Ala Ile Ala Asn Phe Pro Glu Asp Arg Gly Trp Asn Leu Asp Glu Leu  
 65 70 75 80  
 Phe Asp Pro Asp Pro Gly Arg Ala Gly Thr Ser Tyr Val Arg Glu Gly  
 85 90 95  
 Gly Phe Leu Arg Gly Val Ala Asp Phe Asp Ala Gly Leu Phe Gly Ile  
 100 105 110  
 Ser Pro Arg Glu Ala Gln Ala Met Asp Pro Gln Gln Arg Leu Leu Leu  
 115 120 125  
 Glu Ile Ser Trp Glu Val Phe Glu Arg Ala Gly Ile Asp Pro Phe Ser  
 130 135 140  
 Leu Arg Gly Thr Lys Thr Gly Val Phe Ala Gly Leu Ile Tyr His Asp  
 145 150 155 160  
 Tyr Ala Ser Arg Phe Arg Lys Thr Pro Ala Glu Phe Glu Gly Tyr Phe  
 165 170 175  
 Ala Thr Gly Asn Ala Gly Ser Val Ala Ser Gly Arg Val Ala Tyr Thr  
 180 185 190  
 Phe Gly Leu Glu Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser  
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Ser Leu Val Ala Leu His Leu Ala Cys Gln Ser Leu Arg Leu Gly Glu  
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 Cys Asp Leu Ala Leu Ala Gly Gly Ile Ser Val Met Ala Thr Pro Gly  
 225 230 235 240  
 Ala Phe Val Glu Phe Ser Arg Gln Arg Ala Leu Ala Ser Asp Gly Arg  
 245 250 255  
 Cys Lys Pro Phe Ala Asp Ala Ala Asp Gly Thr Gly Trp Gly Glu Gly  
 260 265 270  
 Ala Gly Met Leu Leu Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly  
 275 280 285  
 His Pro Val Leu Ala Ala Val Val Gly Ser Ala Ile Asn Gln Asp Gly  
 290 295 300  
 Thr Ser Asn Gly Leu Thr Ala Pro Ser Gly Pro Ala Gln Gln Arg Val  
 305 310 315 320  
 Ile Arg Gln Ala Leu Ala Asn Ala Gly Leu Ser Pro Ala Glu Val Asp  
 325 330 335  
 Val Val Glu Ala His Gly Thr Gly Thr Ala Leu Gly Asp Pro Ile Glu  
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 Ala Gln Ala Leu Ile Ala Thr Tyr Gly Ala Asn Arg Ser Ala Asp His  
 355 360 365  
 Pro Leu Leu Leu Gly Ser Leu Lys Ser Asn Ile Gly His Thr Gln Ala  
 370 375 380  
 Ala Ala Gly Val Ala Gly Val Ile Lys Ser Val Leu Ala Ile Arg His  
 385 390 395 400  
 Arg Glu Met Pro Arg Ser Leu His Ile Asp Gln Pro Ser Gln His Val  
 405 410 415  
 Asp Trp Ser Ala Gly Ala Val Arg Leu Leu Thr Asp Ser Val Asp Trp  
 420 425 430  
 Pro Asp Leu Gly Arg Pro Arg Arg Ala Gly Val Ser Ser Phe Gly Met  
 435 440 445  
 Ser Gly Thr Asn Ala His Leu Ile Val Glu Glu Val Ser Asp Glu Pro  
 450 455 460  
 Val Ser Gly Ser Thr Glu Pro Thr Gly Ala Phe Pro Trp Pro Leu Ser  
 465 470 475 480  
 Gly Lys Thr Glu Thr Ala Leu Arg Glu Gln Ala Ala Glu Leu Leu Ser  
 485 490 495  
 Val Val Thr Glu His Pro Glu Pro Gly Leu Gly Asp Val Gly Tyr Ser  
 500 505 510  
 Leu Ala Thr Gly Arg Ala Ala Met Glu His Arg Ala Val Val Val Ala  
 515 520 525  
 Asp Asp Arg Asp Ser Phe Val Ala Gly Leu Thr Ala Leu Ala Ala Gly  
 530 535 540

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Val 545 Pro Ala Ala Asn 550 Val Val Gln Gly Ala 555 Ala Asp Cys Lys Gly Lys 560  
 Val 565 Ala Phe Val Phe 565 Pro Gly Gln Gly Ser 570 His Trp Gln Gly Met 575 Ala  
 Arg 580 Glu Leu Ser 580 Glu Ser Ser Pro 585 Val Phe Arg Arg Lys 590 Leu Ala Glu  
 Cys 595 Ala Ala Ala Thr Ala Pro Tyr 600 Val Asp Trp Ser 605 Leu Leu Gly Val  
 Leu 610 Arg Gly Asp Pro Asp 615 Ala Pro Ala Leu Asp 620 Arg Asp Asp Val Ile  
 Gln 625 Leu Ala Leu Phe 630 Ala Met Met Val Ser 635 Leu Ala Glu Leu Trp Arg 640  
 Ser Cys Gly Val 645 Glu Pro Ala Ala Val 650 Val Gly His Ser Gln Gly 655 Glu  
 Ile Ala Ala 660 Ala His Val Ala Gly 665 Ala Leu Ser Leu Thr Asp 670 Ala Val  
 Arg Ile 675 Ile Ala Ala Arg Cys 680 Asp Ala Val Ser Ala 685 Leu Thr Gly Lys  
 Gly 690 Gly Met Leu Ala Ile 695 Ala Leu Pro Glu Ser 700 Ala Val Val Lys Arg  
 Ile 705 Ala Gly Leu Pro 710 Glu Leu Thr Val Ala 715 Ala Val Asn Gly Pro 720 Gly  
 Ser Thr Val Val 725 Ser Gly Glu Pro Ser 730 Ala Leu Glu Arg Leu 735 Gln Thr  
 Glu Leu Thr 740 Ala Glu Asn Val Gln 745 Thr Arg Arg Val Gly 750 Ile Asp Tyr  
 Ala Ser 755 His Ser Pro Gln Ile 760 Ala Gln Val Gln Gly Arg 765 Leu Leu Asp  
 Arg 770 Leu Gly Glu Val Gly 775 Ser Glu Pro Ala Glu 780 Ile Ala Phe Tyr Ser  
 Thr 785 Val Thr Gly Glu Arg 790 Thr Asp Thr Gly Arg 795 Leu Asp Ala Asp Tyr 800  
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 Arg Met Ala 820 Asp Gln Gly Tyr Arg 825 Phe Phe Val Glu Val 830 Ser Pro His  
 Pro Leu 835 Leu Thr Ala Gly Ile 840 Gln Glu Thr Leu Glu 845 Ala Ala Asp Ala  
 Gly 850 Gly Val Val Val Gly 855 Ser Leu Arg Arg Gly 860 Glu Gly Gly Ser Arg  
 Arg 865 Trp Leu Thr Ser 870 Leu Ala Glu Cys Gln Val Arg 875 Gly Leu Pro Val 880



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 Pro Thr Tyr Pro Phe Gln Arg Gln Arg Tyr Trp Leu Glu Ser Ala Glu  
 900 905 910  
 Tyr Asp Ala Gly Asp Leu Gly Ser Val Gly Leu Leu Ser Ala Glu His  
 915 920 925  
 Pro Leu Leu Gly Ala Ala Val Thr Leu Ala Asp Ala Gly Gly Phe Leu  
 930 935 940  
 Leu Thr Gly Lys Leu Ser Val Lys Thr Gln Pro Trp Leu Ala Asp His  
 945 950 955 960  
 Val Val Gly Gly Ala Ile Leu Leu Pro Gly Thr Ala Phe Val Glu Met  
 965 970 975  
 Leu Ile Arg Ala Ala Asp Gln Val Gly Cys Asp Leu Ile Glu Glu Leu  
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 Ser Leu Thr Thr Pro Leu Val Leu Pro Ala Thr Gly Ala Val Gln Val  
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 Gln Ile Ala Val Gly Gly Pro Asp Glu Ala Gly Arg Arg Ser Val Arg  
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 Val His Ser Cys Arg Asp Asp Ala Val Pro Gln Asp Ser Trp Thr Cys  
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 His Ala Thr Gly Thr Leu Thr Ser Ser Asp His Gln Asp Ala Gly Gln  
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 Gly Pro Asp Gly Ile Trp Pro Pro Asn Asp Ala Val Ala Val Pro Leu  
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 Asp Ser Phe Tyr Ala Arg Ala Ala Glu Arg Gly Phe Asp Phe Gly Pro  
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 Ala Phe Gln Gly Leu Gln Ala Ala Trp Lys Arg Gly Asp Glu Ile Phe  
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 Ala Glu Val Gly Leu Pro Thr Ala His Arg Glu Asp Ala Gly Arg Phe  
 105 1110 1115 1120  
 Gly Ile His Pro Ala Leu Leu Asp Ala Ala Leu Gln Ala Leu Gly Ala  
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 Ala Glu Glu Asp Pro Asp Glu Gly Trp Leu Pro Phe Ala Trp Gln Gly  
 1140 1145 1150  
 Val Ser Leu Lys Ala Thr Gly Ala Leu Ser Leu Arg Val His Leu Val  
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 Gln Ala Val Leu Ser Ile Asp Ser Leu Val Leu Arg Gln Ile Ser Asp  
 185 1190 1195 1200  
 Lys Gln Leu Ala Ala Ala Arg Ala Met Glu His Glu Ser Leu Phe Arg  
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Val Asp Trp Lys Arg Ile Ser Pro Gly Ala Ala Lys Pro Val Ser Trp  
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Ala Val Ile Gly Asn Asp Glu Leu Ala Arg Ala Cys Gly Ser Ala Leu  
1235 1240 1245  
Gly Thr Glu Leu His Pro Asp Leu Thr Gly Leu Ala Asp Pro Pro Pro  
1250 1255 1260  
Asp Val Val Val Val Pro Cys Gly Ala Ser Arg Gln Asp Leu Asp Val  
265 1270 1275 1280  
Ala Ser Glu Ala Arg Ala Ala Thr Gln Arg Met Leu Asp Leu Ile Gln  
1285 1290 1295  
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1300 1305 1310  
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1315 1320 1325  
Val His Ala Ala Ser Trp Gly Leu Leu Arg Ser Ala Gln Ser Glu Asn  
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Pro Asp Arg Phe Val Leu Val Asp Val Asp Gly Thr Ala Glu Ser Trp  
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1380 1385 1390  
Glu Asp Ser Arg Ile Pro Val Pro Gly Ala Asp Gly Thr Val Leu Ile  
1395 1400 1405  
Ser Gly Gly Thr Gly Leu Leu Gly Gly Leu Val Ala Arg His Leu Val  
1410 1415 1420  
Ala Glu Arg Gly Val Arg Arg Leu Val Leu Ala Gly Arg Arg Gly Trp  
425 1430 1435 1440  
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1445 1450 1455  
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Asp Arg Leu Leu Thr Thr Ile Ser Ala Glu Phe Pro Leu Arg Gly Val  
1475 1480 1485  
Val His Ala Ala Gly Ala Leu Ala Asp Gly Val Val Glu Ser Leu Thr  
1490 1495 1500  
Pro Glu His Val Ala Lys Val Phe Gly Pro Lys Ala Ala Gly Ala Trp  
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His Leu His Glu Leu Thr Leu Asp Leu Asp Leu Ser Phe Phe Val Leu  
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Phe Ser Ser Phe Ser Gly Val Ala Gly Ala Ala Gly Gln Gly Asn Tyr  
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Ala Ala Ala Asn Ala Phe Leu Asp Gly Leu Ala Gln His Arg Arg Thr  
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Ala Gly Leu Pro Ala Val Ser Leu Ala Trp Gly Leu Trp Glu Gln Pro  
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Ser Gly Met Thr Gly Ala Leu Asp Ala Ala Gly Arg Ser Arg Ile Ala  
585 1590 1595 1600

Arg Thr Asn Pro Pro Met Ser Ala Pro Asp Gly Leu Arg Leu Phe Glu  
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Met Ala Phe Arg Val Pro Gly Glu Ser Leu Leu Val Pro Val His Val  
1620 1625 1630

Asp Leu Asn Ala Leu Arg Ala Asp Ala Ala Asp Gly Gly Val Pro Ala  
1635 1640 1645

Leu Leu Arg Asp Leu Val Pro Ala Pro Val Arg Arg Ser Ala Val Asn  
1650 1655 1660

Glu Ser Ala Asp Val Asn Gly Leu Val Gly Arg Leu Arg Arg Leu Pro  
665 1670 1675 1680

Asp Leu Asp Gln Glu Thr Gln Leu Leu Gly Leu Val Arg Glu His Val  
1685 1690 1695

Ser Ala Val Leu Gly His Ser Gly Ala Val Glu Val Gly Ala Asp Arg  
1700 1705 1710

Ala Phe Arg Asp Leu Gly Phe Asp Ser Leu Ser Gly Val Glu Phe Arg  
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Asn Arg Leu Gly Gly Val Leu Gly Val Arg Leu Pro Ala Thr Ala Val  
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Phe Asp Tyr Pro Thr Pro Arg Ala Leu Val Arg Phe Leu Leu Asp Lys  
745 1750 1755 1760

Leu Ile Gly Gly Val Glu Ala Pro Thr Pro Ala Pro Ala Ala Val Ala  
1765 1770 1775

Ala Val Thr Ala Asp Asp Pro Val Val Ile Val Gly Met Gly Cys Arg  
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Tyr Pro Gly Gly Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala  
1795 1800 1805

Gly Gly Leu Asp Ala Val Ala Glu Phe Pro Asp Asp Arg Gly Trp Asp  
1810 1815 1820

Gln Ala Gly Leu Phe Asp Pro Asp Pro Asp Arg Leu Gly Thr Ser Tyr  
825 1830 1835 1840

Val Cys Glu Gly Gly Phe Leu Arg Asp Ala Ala Glu Phe Asp Ala Gly  
1845 1850 1855

Phe Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln  
1860 1865 1870

Arg Leu Leu Leu Glu Val Ala Trp Glu Thr Val Glu Arg Ala Gly Ile  
1875 1880 1885

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 1890 1895 1900  
 Met His His Asp Tyr Gly Ala Arg Phe Ile Thr Arg Ala Pro Glu Gly  
 905 1910 1915 1920  
 Phe Glu Gly Tyr Leu Gly Asn Gly Ser Ala Gly Gly Val Phe Ser Gly  
 1925 1930 1935  
 Arg Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp  
 1940 1945 1950  
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 1955 1960 1965  
 Leu Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val  
 1970 1975 1980  
 Met Ala Thr Pro Gly Met Phe Val Glu Phe Ser Arg Gln Arg Gly Leu  
 985 1990 1995 2000  
 Ala Ala Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala Asp Gly Thr  
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 065 2070 2075 2080  
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 Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Gln Gly  
 2100 2105 2110  
 Arg Asp Ser Asp Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile  
 2115 2120 2125  
 Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val  
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 2180 2185 2190  
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 2210 2215 2220

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 2260 2265 2270  
 Ser Ser Arg Ala Ala Leu Glu Glu Arg Ala Val Val Leu Gly Ala Asp  
 2275 2280 2285  
 Arg Glu Thr Leu Leu Ser Gly Leu Glu Ala Leu Ala Ser Gly Arg Glu  
 2290 2295 2300  
 Ala Ser Gly Val Val Ser Gly Ser Pro Val Ser Gly Gly Val Gly Phe  
 305 2310 2315 2320  
 Val Phe Ala Gly Gln Gly Gly Gln Trp Leu Gly Met Gly Arg Gly Leu  
 2325 2330 2335  
 Tyr Ser Val Phe Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Ala  
 2340 2345 2350  
 Gly Leu Asp Ala His Leu Gly Gln Asp Val Gly Val Arg Asp Val Val  
 2355 2360 2365  
 Phe Gly Ser Asp Gly Ser Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser  
 2370 2375 2380  
 Gly Leu Phe Ala Leu Gln Val Gly Leu Leu Ser Leu Leu Gly Ser Trp  
 385 2390 2395 2400  
 Gly Val Arg Pro Gly Val Val Leu Gly His Ser Val Gly Glu Phe Ala  
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 Ala Ala Val Ala Ala Gly Val Leu Ser Leu Pro Asp Ala Ala Arg Met  
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 Val Ala Gly Arg Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Ala  
 2435 2440 2445  
 Met Leu Ala Val Ala Ala Gly Glu Glu Gln Leu Arg Pro Leu Leu Ala  
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 Asp Arg Val Asp Gly Ala Gly Ile Ala Ala Val Asn Ala Pro Glu Ser  
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 Val Val Leu Ser Gly Asp Arg Glu Val Leu Asp Asp Ile Ala Gly Ala  
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 Leu Asp Gly Gln Gly Ile Arg Trp Arg Arg Leu Arg Val Ser His Ala  
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 Phe His Ser Tyr Arg Met Asp Pro Met Leu Gln Glu Phe Ala Glu Ile  
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 Ala Arg Ser Val Asp Tyr Arg Arg Gly Asp Leu Pro Val Val Ser Thr  
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 Leu Thr Gly Glu Leu Asp Thr Ala Gly Val Met Ala Thr Pro Glu Tyr  
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Trp Val Arg Gln Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Arg  
 2565 2570 2575  
 Val Leu Ala Gln Gln Gly Val Ala Thr Ile Phe Glu Leu Gly Pro Asp  
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 Ala Thr Leu Ser Ala Leu Ile Pro Asp Cys His Ser Trp Ala Asp Gln  
 2595 2600 2605  
 Ala Met Pro Ile Pro Met Leu Arg Lys Asp Arg Thr Glu Thr Glu Thr  
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 Val Val Ala Ala Val Ala Arg Ala His Thr Arg Gly Val Pro Val Glu  
 625 2630 2635 2640  
 Trp Ser Ala Tyr Phe Ala Gly Thr Gly Ala Arg Arg Val Glu Leu Pro  
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 Thr Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Glu Thr Ser Asp Tyr  
 2660 2665 2670  
 Gly Asp Val Thr Gly Ile Gly Leu Ala Ala Ala Glu His Pro Leu Leu  
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 Gly Ala Val Val Ala Leu Ala Asp Gly Asp Gly Met Val Leu Thr Gly  
 2690 2695 2700  
 Arg Leu Ser Val Gly Thr His Pro Trp Leu Ala Gln His Arg Val Leu  
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 Gly Glu Val Val Val Pro Gly Thr Ala Ile Leu Glu Met Ala Leu His  
 2725 2730 2735  
 Ala Gly Ala Arg Leu Gly Cys Asp Arg Val Glu Glu Leu Thr Leu Glu  
 2740 2745 2750  
 Thr Pro Leu Val Val Pro Glu Arg Ala Ala Gly Ala Gly Ser Arg Gly  
 2755 2760 2765  
 Pro Ala Gly Gly Thr Thr Val Ser Ile Glu Thr Ala Glu Glu Arg Val  
 2770 2775 2780  
 Arg Thr Asn Asp Ala Ile Glu Ile Gln Leu Leu Val Asn Ala Pro Asp  
 785 2790 2795 2800  
 Glu Gly Gly Arg Arg Arg Val Ser Leu Tyr Ser Arg Pro Ala Gly Gly  
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 Ser Arg Gly Gly Gly Trp Thr Arg His Ala Thr Gly Glu Leu Val Val  
 2820 2825 2830  
 Gly Thr Thr Gly Gly Arg Ala Val Pro Asp Trp Ser Ala Glu Gly Ala  
 2835 2840 2845  
 Glu Ser Ile Ala Leu Asp Glu Phe Tyr Val Ala Leu Ala Gly Asn Gly  
 2850 2855 2860  
 Phe Glu Tyr Gly Pro Leu Phe Gln Gly Leu Gln Ala Ala Trp Arg Arg  
 865 2870 2875 2880  
 Gly Asp Glu Val Leu Ala Glu Ile Ala Pro Pro Ala Glu Ala Asp Ala  
 2885 2890 2895

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Met Ala Ser Gly Tyr Leu Leu Asp Pro Ala Leu Leu Asp Ala Ala Leu  
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Gln Ala Ser Ala Leu Gly Asp Arg Pro Glu Gln Gly Gly Ala Trp Leu  
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Pro Phe Ser Phe Thr Gly Val Glu Leu Ser Ala Pro Ala Gly Thr Ile  
2930 2935 2940

Ser Arg Val Arg Leu Glu Thr Arg Arg Pro Asp Ala Ile Ser Val Ala  
945 2950 2955 2960

Val Met Asp Glu Ser Gly Arg Leu Leu Ala Ser Ile Asp Ser Leu Arg  
2965 2970 2975

Leu Arg Ser Val Ser Ser Gly Gln Leu Ala Asn Arg Asp Ala Val Arg  
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Asp Ala Leu Phe Glu Val Thr Trp Glu Pro Val Ala Thr Gln Ser Thr  
2995 3000 3005

Glu Pro Gly Arg Trp Ala Leu Leu Gly Asp Thr Ala Cys Gly Lys Asp  
3010 3015 3020

Asp Leu Ile Lys Leu Ala Thr Asp Ser Ala Asp Arg Cys Ala Asp Leu  
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Ala Ala Leu Ala Glu Lys Leu Asp Ser Ser Ala Leu Val Pro Asp Val  
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Val Val Tyr Cys Ala Gly Glu Gln Ala Asp Pro Gly Thr Gly Ala Ala  
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Ala Leu Ala Glu Thr Gln Gln Thr Leu Ala Leu Leu Gln Ala Trp Leu  
3075 3080 3085

Ala Glu Pro Arg Leu Ala Glu Ala Arg Leu Val Val Val Thr Cys Ala  
3090 3095 3100

Ala Val Thr Thr Ala Pro Ser Asp Gly Ala Ser Glu Leu Ala His Ala  
105 3110 3115 3120

Pro Leu Trp Gly Leu Leu Arg Ala Ala Gln Val Glu Asn Pro Gly Gln  
3125 3130 3135

Phe Val Leu Ala Asp Val Asp Gly Thr Ala Glu Ser Trp Arg Ala Leu  
3140 3145 3150

Pro Ser Ala Leu Gly Ser Met Glu Pro Gln Leu Ala Leu Arg Lys Gly  
3155 3160 3165

Ala Val Arg Ala Pro Arg Leu Ala Ser Val Ala Gly Gln Ile Asp Val  
3170 3175 3180

Pro Ala Val Val Ala Asp Pro Asp Arg Thr Val Leu Ile Ser Gly Gly  
185 3190 3195 3200

Thr Gly Leu Leu Gly Gly Ala Val Ala Arg His Leu Val Thr Glu Arg  
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Gly Val Arg Arg Leu Val Leu Thr Gly Arg Arg Gly Trp Asp Ala Pro  
3220 3225 3230

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Gly Ile Thr Glu Leu Val Gly Glu Leu Asn Gly Leu Gly Ala Val Val  
 3235 3240 3245  
 Asp Val Val Ala Cys Asp Val Ala Asp Arg Ala Asp Leu Glu Ser Leu  
 3250 3255 3260  
 Leu Ala Ala Val Pro Ala Glu Phe Pro Leu Cys Gly Val Val His Ala  
 265 3270 3275 3280  
 Ala Gly Ala Leu Ala Asp Gly Val Ile Glu Ser Leu Ser Pro Asp Asp  
 3285 3290 3295  
 Val Gly Ala Val Phe Gly Pro Lys Ala Ala Gly Ala Trp Asn Leu His  
 3300 3305 3310  
 Glu Leu Thr Arg Asp Thr Asp Leu Ser Phe Phe Ala Leu Phe Ser Ser  
 3315 3320 3325  
 Leu Ser Gly Val Ala Gly Ala Pro Gly Gln Gly Asn Tyr Ala Ala Ala  
 3330 3335 3340  
 Asn Ala Phe Leu Asp Ala Leu Ala His Tyr Arg Arg Ser Gln Gly Leu  
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 Pro Ala Val Ser Leu Ala Trp Gly Leu Trp Glu Gln Pro Ser Gly Met  
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 Thr Glu Thr Leu Ser Glu Val Asp Arg Ser Arg Ile Ala Arg Ala Asn  
 3380 3385 3390  
 Pro Pro Leu Ser Thr Lys Glu Gly Leu Arg Leu Phe Asp Ala Gly Leu  
 3395 3400 3405  
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 Leu Val Pro Pro Ile Arg Arg Asn Arg Arg Ala Ser Gly Thr Glu Leu  
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 3490 3495 3500  
 Leu Ala Gly Val Leu Gly Val Arg Leu Pro Ala Thr Ala Val Phe Asp  
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 Tyr Pro Thr Pro Arg Ala Leu Ala Arg Phe Leu His Gln Glu Leu Ala  
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 Asp Glu Ile Ala Thr Thr Pro Ala Pro Val Thr Thr Thr Arg Ala Pro  
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 Val Ala Glu Asp Asp Leu Val Ala Ile Val Gly Met Gly Cys Arg Phe  
 3555 3560 3565



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Pro Gly Gln Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala Gly  
 3570 3575 3580  
 Gly Val Asp Ala Val Ala Asp Phe Pro Ala Asp Arg Gly Trp Asp Leu  
 585 3590 3595 3600  
 Ala Gly Leu Phe Asp Pro Asp Pro Glu Arg Ala Gly Lys Thr Tyr Val  
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 Arg Glu Gly Ala Phe Leu Thr Asp Ala Asp Arg Phe Asp Ala Gly Phe  
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 Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg  
 3635 3640 3645  
 Leu Leu Leu Glu Leu Ser Trp Glu Ala Ile Glu Arg Ala Gly Ile Asp  
 3650 3655 3660  
 Pro Gly Ser Leu Arg Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met  
 665 3670 3675 3680  
 Tyr His Asp Tyr Gly Ala Arg Phe Ala Ser Arg Ala Pro Glu Gly Phe  
 3685 3690 3695  
 Glu Gly Tyr Leu Gly Asn Gly Ser Ala Gly Ser Val Ala Ser Gly Arg  
 3700 3705 3710  
 Ile Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr  
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 Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ser Leu  
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 Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met  
 745 3750 3755 3760  
 Ser Thr Pro Gly Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala  
 3765 3770 3775  
 Pro Asp Gly Arg Cys Lys Ser Phe Ala Glu Ser Ala Asp Gly Thr Gly  
 3780 3785 3790  
 Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala  
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 Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser  
 825 3830 3835 3840  
 Gln Gln Arg Val Ile Gln Gln Ala Leu Ala Ser Ala Gly Leu Ser Val  
 3845 3850 3855  
 Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly  
 3860 3865 3870  
 Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg  
 3875 3880 3885  
 Asp Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly  
 3890 3895 3900

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His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met  
 905 3910 3915 3920  
 Ala Met Arg His Gly Gln Leu Pro Arg Thr Leu His Val Asp Ala Pro  
 3925 3930 3935  
 Ser Ser Gln Val Asp Trp Ser Ala Gly Arg Val Gln Leu Leu Thr Glu  
 3940 3945 3950  
 Asn Thr Pro Trp Pro Asp Ser Gly Arg Pro Cys Arg Val Gly Val Ser  
 3955 3960 3965  
 Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Ser  
 3970 3975 3980  
 Thr Gly Gln Met Asp Gln Ala Ala Glu Pro Asp Ser Ser Pro Val Leu  
 985 3990 3995 4000  
 Asp Val Pro Val Val Pro Trp Val Val Ser Gly Lys Thr Pro Glu Ala  
 4005 4010 4015  
 Leu Ser Ala Gln Ala Ala Thr Leu Ala Thr Tyr Leu Asp Gln Asn Val  
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 Asp Val Ser Pro Leu Asp Val Gly Ile Ser Leu Ala Val Thr Arg Ser  
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 Ala Leu Asp Glu Arg Ala Val Val Leu Gly Ser Asp Arg Asp Thr Leu  
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 Leu Ser Gly Leu Asn Ala Leu Ala Ala Gly His Glu Ala Ala Gly Val  
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 Val Thr Gly Pro Val Gly Ile Gly Gly Arg Thr Gly Phe Val Phe Ala  
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 Phe Pro Ala Phe Ala Gly Ala Phe Asp Glu Ala Cys Ala Glu Leu Asp  
 4115 4120 4125  
 Ala Asn Leu Gly Arg Glu Val Gly Val Arg Asp Val Val Phe Gly Ser  
 4130 4135 4140  
 Asp Glu Ser Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser Gly Leu Phe  
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 Ala Leu Gln Val Gly Leu Trp Glu Leu Leu Gly Thr Trp Gly Val Arg  
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 Pro Ser Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe  
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 Ala Ala Gly Val Leu Ser Met Ala Glu Ala Ala Arg Leu Val Ala Gly  
 4195 4200 4205  
 Arg Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Ala Met Leu Ala  
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 Val Ser Ala Thr Glu Ala Arg Val Gly Pro Leu Leu Asp Gly Val Arg  
 225 4230 4235 4240

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Asp Arg Val Gly Val Ala Ala Val Asn Ala Pro Gly Ser Val Val Leu  
 4245 4250 4255  
 Ser Gly Asp Arg Asp Val Leu Asp Gly Ile Ala Gly Arg Leu Asp Gly  
 4260 4265 4270  
 Gln Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser  
 4275 4280 4285  
 His Arg Met Asp Pro Met Leu Ala Glu Phe Ala Glu Leu Ala Arg Ser  
 4290 4295 4300  
 Val Asp Tyr Arg Ser Pro Arg Leu Pro Ile Val Ser Thr Leu Thr Gly  
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 Asn Leu Asp Asp Val Gly Val Met Ala Thr Pro Glu Tyr Trp Val Arg  
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 Gln Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Gln Ala Leu Val  
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 Asp Gln Gly Val Asp Thr Ile Val Glu Leu Gly Pro Asp Gly Ala Leu  
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 Ser Ser Leu Val Gln Glu Cys Val Ala Glu Ser Gly Arg Ala Thr Gly  
 4370 4375 4380  
 Ile Pro Leu Val Arg Arg Asp Arg Asp Glu Val Arg Thr Val Leu Asp  
 385 4390 4395 4400  
 Ala Leu Ala Gln Thr His Thr Arg Gly Gly Ala Val Asp Trp Gly Ser  
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 Phe Phe Ala Gly Thr Arg Ala Thr Gln Val Asp Leu Pro Thr Tyr Ala  
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 Phe Gln Arg Gln Arg Tyr Trp Leu Glu Pro Ser Asp Ser Gly Asp Val  
 4435 4440 4445  
 Thr Gly Val Gly Leu Thr Gly Ala Glu His Pro Leu Leu Gly Ala Val  
 4450 4455 4460  
 Val Pro Val Ala Gly Gly Asp Glu Val Leu Leu Thr Gly Arg Leu Ser  
 4465 4470 4475 4480  
 Val Gly Thr His Pro Trp Leu Ala Glu His Arg Val Leu Gly Glu Val  
 4485 4490 4495  
 Val Val Pro Gly Thr Ala Leu Leu Glu Met Ala Trp Arg Ala Gly Ser  
 4500 4505 4510  
 Gln Val Gly Cys Glu Arg Val Glu Leu Thr Leu Glu Ala Pro Leu  
 4515 4520 4525  
 Val Leu Pro Glu Arg Gly Ala Ala Ala Val Gln Leu Ala Val Gly Ala  
 4530 4535 4540  
 Pro Asp Glu Ala Gly Arg Arg Ser Leu Gln Leu Tyr Ser Arg Gly Ala  
 545 4550 4555 4560  
 Asp Glu Asp Gly Asp Trp Arg Arg Ile Ala Ser Gly Leu Leu Ala Gln  
 4565 4570 4575

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Ala Asn Ala Val Pro Pro Ala Asp Ser Thr Ala Trp Pro Pro Asp Gly  
4580 4585 4590

Ala Gly Gln Val Asp Leu Ala Glu Phe Tyr Glu Arg Leu Ala Glu Arg  
4595 4600 4605

Gly Leu Thr Tyr Gly Pro Val Phe Gln Gly Leu Arg Ala Ala Trp Arg  
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His Gly Asp Asp Ile Phe Ala Glu Leu Ala Gly Ser Pro Asp Ala Ser  
625 4630 4635 4640

Gly Phe Gly Ile His Pro Ala Leu Leu Asp Ala Ala Leu His Ala Met  
4645 4650 4655

Ala Leu Gly Ala Ser Pro Asp Ser Glu Ala Arg Leu Pro Phe Ser Trp  
4660 4665 4670

Arg Gly Ala Gln Leu Tyr Arg Ala Glu Gly Ala Ala Leu Arg Val Arg  
4675 4680 4685

Leu Ser Pro Leu Gly Ser Gly Ala Val Ser Leu Thr Leu Val Asp Ala  
4690 4695 4700

Thr Gly Arg Arg Val Ala Ala Val Glu Ser Leu Ser Thr Arg Pro Val  
705 4710 4715 4720

Ser Thr Asp Gln Ile Gly Ala Gly Arg Gly Asp Gln Glu Arg Leu Leu  
4725 4730 4735

His Val Glu Trp Val Arg Ser Ala Glu Ser Ala Gly Met Ser Leu Thr  
4740 4745 4750

Ser Cys Ala Val Val Gly Leu Gly Glu Pro Glu Trp His Ala Ala Leu  
4755 4760 4765

Lys Thr Thr Gly Val Gln Val Glu Ser His Ala Asp Leu Ala Ser Leu  
4770 4775 4780

Ala Thr Glu Val Ala Lys Arg Gly Ser Ala Pro Gly Ala Val Ile Val  
785 4790 4795 4800

Pro Cys Pro Arg Pro Arg Ala Met Gln Glu Leu Pro Thr Ala Ala Arg  
4805 4810 4815

Arg Ala Thr Gln Gln Ala Met Ala Met Leu Gln Gln Trp Leu Ala Asp  
4820 4825 4830

Asp Arg Phe Val Ser Thr Arg Leu Ile Leu Leu Thr His Arg Ala Val  
4835 4840 4845

Ser Ala Val Ala Gly Glu Asp Val Leu Asp Leu Val His Ala Pro Leu  
4850 4855 4860

Trp Gly Leu Val Arg Ser Ala Gln Ala Glu His Pro Asp Arg Phe Ala  
865 4870 4875 4880

Leu Ile Asp Met Asp Asp Glu Arg Ala Ser Gln Thr Ala Leu Ala Glu  
4885 4890 4895

Ala Leu Thr Ala Gly Glu Ala Gln Leu Ala Val Arg Ser Gly Val Val  
4900 4905 4910

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Leu Ala Pro Arg Leu Gly Gln Val Lys Val Ser Gly Gly Glu Ala Phe  
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 Arg Trp Asp Glu Gly Thr Val Leu Val Thr Gly Gly Thr Gly Gly Leu  
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 Gly Ala Leu Leu Ala Arg His Leu Val Ser Ala His Gly Val Arg His  
 945 4950 4955 4960  
 Leu Leu Leu Ala Ser Arg Arg Gly Leu Ala Ala Pro Gly Ala Asp Glu  
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 Cys Asp Ser Ala Asp Arg Asp Ser Leu Ala Arg Leu Val Ala Ser Val  
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 Pro Ala Glu Asn Pro Leu Arg Val Val Val His Ala Ala Gly Val Leu  
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 Asp Asp Gly Val Leu Met Ser Met Ser Pro Glu Arg Leu Asp Ala Val  
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 Leu Arg Pro Lys Val Asp Ala Ala Trp Tyr Leu His Glu Leu Thr Arg  
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 Glu Leu Gly Leu Ser Ala Phe Val Leu Phe Ser Ser Val Ala Gly Leu  
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 Phe Gly Gly Ala Gly Gln Ser Asn Tyr Ala Ala Gly Asn Ala Phe Leu  
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 Asp Ala Leu Ala His Cys Arg Gln Ala Gln Gly Leu Pro Ala Leu Ser  
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 Leu Ala Ser Gly Leu Trp Ala Ser Ile Asp Gly Met Ala Gly Asp Leu  
 105 5110 5115 5120  
 Ala Ala Ala Asp Val Glu Arg Leu Ser Arg Ala Gly Ile Gly Pro Leu  
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 Ser Ala Pro Gly Gly Leu Ala Leu Phe Asp Ala Ala Val Gly Ser Asp  
 5140 5145 5150  
 Glu Pro Leu Leu Ala Pro Val Arg Leu Asp Val Glu Ala Leu Arg Val  
 5155 5160 5165  
 Gln Ala Arg Ser Val Gln Thr Arg Ile Pro Glu Met Leu His Gly Met  
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 Ala Met Gly Pro Ser Arg Arg Thr Pro Phe Thr Ser Arg Val Glu Pro  
 185 5190 5195 5200  
 Leu His Glu Arg Leu Ala Gly Leu Ser Glu Gly Glu Arg Arg Gln Gln  
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 Val Leu Gln Arg Val Arg Ala Asp Ile Ala Val Val Leu Gly His Gly  
 5220 5225 5230  
 Arg Ser Ser Asp Val Asp Ile Glu Lys Pro Leu Ala Glu Leu Gly Phe  
 5235 5240 5245

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Asp Ser Leu Thr Ala Ile Glu Leu Arg Asn Arg Leu Ala Thr Ala Thr  
 5250 5255 5260  
 Gly Leu Arg Leu Pro Ala Thr Leu Ala Phe Asp His Gly Thr Ala Ala  
 265 5270 5275 5280  
 Ala Leu Ala Gln His Val Cys Ala Gln Leu Gly Thr Ala Thr Ala Pro  
 5285 5290 5295  
 Ala Pro Arg Arg Thr Asp Asp Asn Asp Ala Thr Glu Pro Val Arg Ser  
 5300 5305 5310  
 Leu Phe Gln Gln Ala Tyr Ala Ala Gly Arg Ile Leu Asp Gly Met Asp  
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 Leu Val Lys Val Ala Ala Gln Leu Arg Pro Val Phe Gly Ser Pro Gly  
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 Glu Leu Glu Ser Leu Pro Lys Pro Val Gln Leu Ser Arg Gly Pro Glu  
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 Glu Leu Ala Leu Val Cys Met Pro Ala Leu Ile Gly Met Pro Pro Ala  
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 Gln Gln Tyr Ala Arg Ile Ala Ala Gly Phe Arg Asp Val Arg Asp Val  
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 Ser Val Ile Pro Met Pro Gly Phe Ile Ala Gly Glu Pro Leu Pro Ser  
 5395 5400 5405  
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 Phe Ala Gly Gly Ser Phe Val Leu Val Gly His Ser Ser Gly Gly Trp  
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 Leu Ala His Glu Val Ala Gly Glu Leu Glu Arg Arg Gly Val Val Pro  
 5445 5450 5455  
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 5460 5465 5470  
 Arg Phe Ser Val Ala Met Ala His Arg Thr Tyr Glu Lys Leu Ala Thr  
 5475 5480 5485  
 Phe Thr Asp Met Gln Asp Val Gly Ile Thr Ala Met Gly Gly Tyr Phe  
 5490 5495 5500  
 Arg Met Phe Thr Glu Trp Thr Pro Thr Pro Ile Gly Ala Pro Thr Leu  
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 5540 5545 5550  
 Gln Val Pro Gly Asp His Phe Ser Met Met Asp Glu His Ala Gly Ser  
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LeA33955-US

Ala Arg Gln Arg  
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<213> Saccharopolyspora spinosa

<220>  
<221> CDS  
<222> (1)..(987)  
<223> ORF23; dNDP-glucose-4,6-dehydratase

## LeA33955-US

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Met	Arg	Ile	Leu	Val	Thr	Gly	Gly	Ala	Gly	Phe	Ile	Gly	Ser	His	Tyr	
1				5					10					15		
ggt	cgg	cag	ttg	ctc	ggt	ggt	gcg	tac	ccc	gca	ttc	gcc	gac	gcc	gac	96
Val	Arg	Gln	Leu	Leu	Gly	Gly	Ala	Tyr	Pro	Ala	Phe	Ala	Asp	Ala	Asp	
			20					25					30			
gtg	gtc	gtg	ctc	gac	aag	ctc	acc	tac	gcc	ggc	aac	gag	gcg	aac	ctg	144
Val	Val	Val	Leu	Asp	Lys	Leu	Thr	Tyr	Ala	Gly	Asn	Glu	Ala	Asn	Leu	
		35					40					45				
gcg	ccg	gtc	gcg	gac	aac	ccc	cgg	ctg	aag	ttc	gtc	tgc	ggc	gac	atc	192
Ala	Pro	Val	Ala	Asp	Asn	Pro	Arg	Leu	Lys	Phe	Val	Cys	Gly	Asp	Ile	
	50					55					60					
tgc	gac	cgc	gaa	ctg	gtt	ggc	ggc	ctg	atg	tcc	ggc	gtg	gac	gtg	gtg	240
Cys	Asp	Arg	Glu	Leu	Val	Gly	Gly	Leu	Met	Ser	Gly	Val	Asp	Val	Val	
65					70					75					80	
gtg	cac	ttc	gcc	gcc	gaa	acc	cac	gtc	gac	cgc	tcg	atc	acc	ggc	tcg	288
Val	His	Phe	Ala	Ala	Glu	Thr	His	Val	Asp	Arg	Ser	Ile	Thr	Gly	Ser	
				85					90					95		
gac	gcc	ttc	gtg	atc	acc	aac	gtg	gtc	ggc	acc	aac	gtg	ctg	ctg	cag	336
Asp	Ala	Phe	Val	Ile	Thr	Asn	Val	Val	Gly	Thr	Asn	Val	Leu	Leu	Gln	
			100					105					110			
gcc	gcg	ctc	gac	gcc	gag	atc	ggc	aag	ttc	gtg	cac	gtt	tcc	acc	gac	384
Ala	Ala	Leu	Asp	Ala	Glu	Ile	Gly	Lys	Phe	Val	His	Val	Ser	Thr	Asp	
		115					120					125				
gag	gtc	tac	ggc	tcc	atc	gag	gac	ggc	tcg	tgg	ccc	gaa	gac	cac	gcg	432
Glu	Val	Tyr	Gly	Ser	Ile	Glu	Asp	Gly	Ser	Trp	Pro	Glu	Asp	His	Ala	
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ctg	gag	ccg	aat	tcc	ccg	tac	tcg	gcg	gcg	aaa	gcg	ggc	tcg	gac	ctg	480
Leu	Glu	Pro	Asn	Ser	Pro	Tyr	Ser	Ala	Ala	Lys	Ala	Gly	Ser	Asp	Leu	
145					150					155					160	
ctg	gcc	cgc	gcc	tac	cac	cgc	acc	cac	gga	ctg	ccg	gtg	tgc	atc	acc	528
Leu	Ala	Arg	Ala	Tyr	His	Arg	Thr	His	Gly	Leu	Pro	Val	Cys	Ile	Thr	
				165					170					175		
cgc	tgc	tcc	aac	aac	tac	ggg	ccc	tac	cag	ttc	ccg	gag	aag	gtg	ctg	576
Arg	Cys	Ser	Asn	Asn	Tyr	Gly	Pro	Tyr	Gln	Phe	Pro	Glu	Lys	Val	Leu	
			180					185					190			
ccg	ctg	ttc	atc	acg	aac	ctg	atg	gac	ggc	agc	cag	gtg	ccg	ctc	tac	624
Pro	Leu	Phe	Ile	Thr	Asn	Leu	Met	Asp	Gly	Ser	Gln	Val	Pro	Leu	Tyr	
		195					200					205				
ggc	gac	ggg	ctc	aac	gtg	cgg	gac	tgg	ctg	cac	gtc	agc	gac	cac	tgc	672
Gly	Asp	Gly	Leu	Asn	Val	Arg	Asp	Trp	Leu	His	Val	Ser	Asp	His	Cys	
	210					215					220					
cgg	ggc	atc	cag	ctg	gtg	gcc	gac	tcc	ggg	cgc	gcg	ggc	gag	atc	tac	720
Arg	Gly	Ile	Gln	Leu	Val	Ala	Asp	Ser	Gly	Arg	Ala	Gly	Glu	Ile	Tyr	
225					230				235					240		
aac	atc	ggc	ggc	ggc	acc	gag	ctg	acc	aac	aac	gag	ctg	acc	gag	cgg	768



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Asn	Ile	Gly	Gly	Gly	Thr	Glu	Leu	Thr	Asn	Asn	Glu	Leu	Thr	Glu	Arg		
				245					250					255			
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Leu	Leu	Ala	Glu	Leu	Gly	Leu	Asp	Trp	Ser	Val	Val	Arg	Pro	Val	Thr		
			260					265					270				
gac	cgc	aag	ggc	cac	gac	cgc	cgc	tac	tcg	gtg	gac	cac	agc	aag	atc	864	
Asp	Arg	Lys	Gly	His	Asp	Arg	Arg	Tyr	Ser	Val	Asp	His	Ser	Lys	Ile		
		275					280					285					
gtc	gag	gaa	ctg	ggg	tac	gcg	ccg	cag	gtc	gac	ttc	gag	acc	ggg	ctg	912	
Val	Glu	Glu	Leu	Gly	Tyr	Ala	Pro	Gln	Val	Asp	Phe	Glu	Thr	Gly	Leu		
	290					295					300						
cgc	gag	aca	atc	cgc	tgg	tac	cag	gac	aac	cgg	gac	tgg	tgg	gag	ccg	960	
Arg	Glu	Thr	Ile	Arg	Trp	Tyr	Gln	Asp	Asn	Arg	Asp	Trp	Trp	Glu	Pro		
305					310					315					320		
ctg	aag	gcc	cga	tcg	gcg	gtg	gct	cga	tga							990	
Leu	Lys	Ala	Arg	Ser	Ala	Val	Ala	Arg									
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 <211> 329  
 <212> PRT  
 <213> Saccharopolyspora spinosa

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 Val Val Val Leu Asp Lys Leu Thr Tyr Ala Gly Asn Glu Ala Asn Leu  
 35 40 45  
 Ala Pro Val Ala Asp Asn Pro Arg Leu Lys Phe Val Cys Gly Asp Ile  
 50 55 60  
 Cys Asp Arg Glu Leu Val Gly Gly Leu Met Ser Gly Val Asp Val Val  
 65 70 75 80  
 Val His Phe Ala Ala Glu Thr His Val Asp Arg Ser Ile Thr Gly Ser  
 85 90 95  
 Asp Ala Phe Val Ile Thr Asn Val Val Gly Thr Asn Val Leu Leu Gln  
 100 105 110  
 Ala Ala Leu Asp Ala Glu Ile Gly Lys Phe Val His Val Ser Thr Asp  
 115 120 125  
 Glu Val Tyr Gly Ser Ile Glu Asp Gly Ser Trp Pro Glu Asp His Ala  
 130 135 140  
 Leu Glu Pro Asn Ser Pro Tyr Ser Ala Ala Lys Ala Gly Ser Asp Leu  
 145 150 155 160  
 Leu Ala Arg Ala Tyr His Arg Thr His Gly Leu Pro Val Cys Ile Thr  
 165 170 175

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Arg	Cys	Ser	Asn	Asn	Tyr	Gly	Pro	Tyr	Gln	Phe	Pro	Glu	Lys	Val	Leu
			180					185					190		
Pro	Leu	Phe	Ile	Thr	Asn	Leu	Met	Asp	Gly	Ser	Gln	Val	Pro	Leu	Tyr
		195					200					205			
Gly	Asp	Gly	Leu	Asn	Val	Arg	Asp	Trp	Leu	His	Val	Ser	Asp	His	Cys
	210					215					220				
Arg	Gly	Ile	Gln	Leu	Val	Ala	Asp	Ser	Gly	Arg	Ala	Gly	Glu	Ile	Tyr
	225				230					235					240
Asn	Ile	Gly	Gly	Gly	Thr	Glu	Leu	Thr	Asn	Asn	Glu	Leu	Thr	Glu	Arg
				245					250					255	
Leu	Leu	Ala	Glu	Leu	Gly	Leu	Asp	Trp	Ser	Val	Val	Arg	Pro	Val	Thr
			260					265					270		
Asp	Arg	Lys	Gly	His	Asp	Arg	Arg	Tyr	Ser	Val	Asp	His	Ser	Lys	Ile
		275					280					285			
Val	Glu	Glu	Leu	Gly	Tyr	Ala	Pro	Gln	Val	Asp	Phe	Glu	Thr	Gly	Leu
	290					295					300				
Arg	Glu	Thr	Ile	Arg	Trp	Tyr	Gln	Asp	Asn	Arg	Asp	Trp	Trp	Glu	Pro
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Leu	Lys	Ala	Arg	Ser	Ala	Val	Ala	Arg							
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<211> 918

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1)..(915)

<223> ORF24; dNDP-4-keto-6-deoxyglucose-3,5-epimerase

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tcg	gag	ctg	gcc	cgg	atc	ctc	ccc	gcg	cgg	acg	ggg	gcg	ctg	gtg	cac	96
Ser	Glu	Leu	Ala	Arg	Ile	Leu	Pro	Ala	Arg	Thr	Gly	Ala	Leu	Val	His	
			20					25					30			
cgg	ccg	ggt	tcc	ggg	gaa	ctg	gac	gtc	acc	gac	gcc	gag	gag	gtc	gcc	144
Arg	Pro	Gly	Ser	Gly	Glu	Leu	Asp	Val	Thr	Asp	Ala	Glu	Glu	Val	Ala	
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gac	gcg	ttg	ggt	tcc	ttc	gcg	gag	acg	gcg	aag	gac	gcg	gag	ctg	cga	192
Asp	Ala	Leu	Gly	Ser	Phe	Ala	Glu	Thr	Ala	Lys	Asp	Ala	Glu	Leu	Arg	
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ccg	gtg	gtg	atc	aac	gcc	gcg	gcg	tac	acg	gcg	gtg	gac	gcg	gcc	gag	240
Pro	Val	Val	Ile	Asn	Ala	Ala	Ala	Tyr	Thr	Ala	Val	Asp	Ala	Ala	Glu	
	65				70					75					80	

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acg gat tac gtg ttc ccc ggt gat ggg gcc cgg ccg tac gag ccg acg Thr Asp Tyr 115 Val Phe Pro Gly Asp 120 Gly Ala Arg Pro Tyr 125 Glu Pro Thr	384
gac ccg acc ggg ccg cga tcg gtc tac ggg cgc acc aag ctc gaa ggc Asp Pro 130 Thr Gly Pro Arg Ser 135 Val Tyr Gly Arg Thr 140 Lys Leu Glu Gly	432
gaa ccg gcc gtg ctg gag tcc ggc gcg cgg gcc tgg gtg gtg cgc acg Glu Arg Ala Val Leu Glu Ser Gly Ala Arg Ala 155 Trp Val Val Arg Thr 160	480
gca tgg gtg tac ggc gcg agc ggc aag aac ttc ctg aaa acg atg atc Ala Trp Val Tyr 165 Gly Ala Ser Gly Lys 170 Asn Phe Leu Lys Thr Met Ile 175	528
cgc ctc tcg ggg gag cgc gac acg ctg tcc gtt gtg gac gat cag atc Arg Leu Ser 180 Gly Glu Arg Asp Thr 185 Ser Val Val Asp 190 Asp Gln Ile	576
ggc tcg ccg act tgg gcg gcg gac ctg gcg agc ggc ctg ctg gag ctg Gly Ser Pro 195 Thr Trp Ala Ala Asp 200 Leu Ala Ser Gly Leu Leu Glu Leu	624
gcc gaa ccg gtc gcc gaa cgc cgt gga ccg gag cag aag gtg ctg cac Ala Glu Arg Val Ala Glu Arg Arg Gly Pro Glu Gln Lys Val Leu His 210 215 220	672
tgc acc aat tcc ggc cag gtg acc tgg tac gag ttc gcg ccg gcg atc Cys Thr Asn Ser Gly Gln Val Thr Trp Tyr 235 Phe Ala Arg Ala Ile 240	720
ttc gcg gaa ttc ggc ctg gac gag aac cgc gtc cac ccg tgc acg acg Phe Ala Glu Phe Gly Leu Asp Glu Asn Arg 250 Val His Pro Cys Thr Thr 255	768
gcg gac ttc ccc ctc ccg gcg cac cgc ccg gcc tac tcg gtc ctg tcc Ala Asp Phe Pro Leu Pro Ala His Arg 265 Pro Ala Tyr Ser Val Leu Ser 270	816
gac gtg gcg tgg cga gag gcg ggc ctg acc ccg atg cgc acc tgg ccg Asp Val Ala Trp Arg Glu Ala Gly 280 Leu Thr Pro Met Arg 285 Thr Trp Arg	864
gaa gcc ctg gcg gcg gcc ttc gag aaa gac ggc gaa acc ctc cga acc Glu Ala Leu Ala Ala Ala Phe 295 Glu Lys Asp Gly Glu Thr Leu Arg Thr 300	912
cgc tga Arg 305	918

<210> 55  
<211> 305

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 55

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Ser Glu Leu Ala Arg Ile Leu Pro Ala Arg Thr Gly Ala Leu Val His
 20      25      30
Arg Pro Gly Ser Gly Glu Leu Asp Val Thr Asp Ala Glu Glu Val Ala
 35      40      45
Asp Ala Leu Gly Ser Phe Ala Glu Thr Ala Lys Asp Ala Glu Leu Arg
 50      55      60
Pro Val Val Ile Asn Ala Ala Tyr Thr Ala Val Asp Ala Ala Glu
 65      70      75      80
Ser Asp Pro Asp Arg Ala Ala Arg Ile Asn Ala Glu Gly Ala Ala Ser
 85      90      95
Leu Ala Lys Ala Cys Arg Ser Ser Gly Leu Pro Leu Val His Val Ser
100      105      110
Thr Asp Tyr Val Phe Pro Gly Asp Gly Ala Arg Pro Tyr Glu Pro Thr
115      120      125
Asp Pro Thr Gly Pro Arg Ser Val Tyr Gly Arg Thr Lys Leu Glu Gly
130      135      140
Glu Arg Ala Val Leu Glu Ser Gly Ala Arg Ala Trp Val Val Arg Thr
145      150      155      160
Ala Trp Val Tyr Gly Ala Ser Gly Lys Asn Phe Leu Lys Thr Met Ile
165      170      175
Arg Leu Ser Gly Glu Arg Asp Thr Leu Ser Val Val Asp Asp Gln Ile
180      185      190
Gly Ser Pro Thr Trp Ala Ala Asp Leu Ala Ser Gly Leu Leu Glu Leu
195      200      205
Ala Glu Arg Val Ala Glu Arg Arg Gly Pro Glu Gln Lys Val Leu His
210      215      220
Cys Thr Asn Ser Gly Gln Val Thr Trp Tyr Glu Phe Ala Arg Ala Ile
225      230      235      240
Phe Ala Glu Phe Gly Leu Asp Glu Asn Arg Val His Pro Cys Thr Thr
245      250      255
Ala Asp Phe Pro Leu Pro Ala His Arg Pro Ala Tyr Ser Val Leu Ser
260      265      270
Asp Val Ala Trp Arg Glu Ala Gly Leu Thr Pro Met Arg Thr Trp Arg
275      280      285
Glu Ala Leu Ala Ala Ala Phe Glu Lys Asp Gly Glu Thr Leu Arg Thr
290      295      300

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Arg  
305

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